15th Global Symposium for Regulators (Libreville, 2015)

Mind the Digital Gap – Regulatory incentives to achieve digital opportunities

Discussion Papers

This PDF is provided by the International Telecommunication Union (ITU) Library & Archives Service from an officially produced electronic file.

Ce PDF a été élaboré par le Service de la bibliothèque et des archives de l'Union internationale des télécommunications (UIT) à partir d'une publication officielle sous forme électronique.

Este documento PDF lo facilita el Servicio de Biblioteca y Archivos de la Unión Internacional de Telecomunicaciones (UIT) a partir de un archivo electrónico producido oficialmente.

هذه النسخة بنسق PDF مقدمة من الاتحاد الدولي للاتصالات (ITU) ، قسم المكتبة والمحفوظات هو تخوماً يهو نم لمكتإ فـملـ ينورتكإ يجر ى إعداده ميرسً.

本PDF版本由国际电信联盟（ITU）图书馆和档案服务室提供。来源为正式出版的电子文件。

Настоящий файл в формате PDF предоставлен библиотечно-архивной службой Международного союза электросвязи (МСЭ) на основе официально созданного электронного файла.

© International Telecommunication Union

GSR discussion paper

Investment strategies for the deployment of broadband and access to the digital economy

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 25 june 2015.

The views expressed in this paper are those of the authors and do not necessarily reflect the opinions of ITU or its Membership.

Table of Contents

Page

1 Executive summary v

2 Introduction 1

3 Global investment trends 2

3.1 Investment: driving telecoms revenue growth 2

3.2 Fixed network investment trends 3

3.3 Wireless network investment trends 3

3.4 Market consolidation 6

3.5 Tech clusters 6

4 PPP investment strategies in broadband infrastructure 7

4.1 Overview of PPPs 7

4.2 Private DBO 8

4.2.1 Case study: Mobile Infrastructure Project (MIP), UK 9

4.2.2 Case study: National Broadband Scheme (NBS), Ireland 11

4.3 Public outsourcing 12

4.3.1 Case study: National ICT Broadband Backbone (NICTBB), Tanzania 13

4.3.2 Case study: Johannesburg Broadband Network Project (JBNP), South Africa 15

4.4 Joint venture (JV) 16

4.4.1 Case study: Metroweb, Italy 17

4.5 Public DBO 18

4.5.1 Case study: Qatar National Broadband Network (QNBN), Qatar 19

4.6 PPP implementation strategies 21

4.6.1 Consideration of local market conditions 21

4.6.2 Development of broadband targets 21

4.6.3 Open-access networks 22

4.6.4 Procurement 23

5 Alternative approaches to funding broadband networks 23

5.1 Existing market players 23

5.1.1 Case study: MGTS, Russia 24

5.2 New market entrants 25

5.2.1 Case study: Google Fiber, USA 25

5.2.2 Case study: Google Fiber, Uganda 27

5.3 New financiers 27

5.3.1 Case study: SIGFOX, France 28
5.3.2 Case study: Seacom, Africa 29
5.3.3 Case study: Facebook Asia–Pacific Gateway, Asia 30
5.4 Not-for-profit investors 31
5.4.1 Case study: Community broadband, Germany 32
5.5 Investments in disruptive technologies 33

6 Financial innovations in funding services and applications 34

6.1 Crowdfunding 34
6.1.1 Case study: Star Citizen, USA 35
6.1.2 Case study: Pebble, USA 36
6.1.3 Case study: Shyp, USA 37
6.2 Pension funding 38
6.2.1 Case study: Hipcom, UK 38
6.3 Bitcoin currency 39
6.3.1 Case study: meXBT, Mexico 40
6.4 Charity or non-profit institutions 41
6.4.1 Case study: Aentropico, Colombia 41

7 Conclusions 42

7.1 Investment trends 42
7.2 Summary of best-practice regulatory considerations 43

Abbreviations 46

Annex 1 – Procurement principles 47

Annex 2 – Sources 50

©ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Investment strategies for the deployment of broadband and access to the digital economy

Authors: Iqbal Singh Bedi, Nuno Afonso, Dr Matt Yardley from Analysys Mason

Executive summary

This paper describes common and innovative investment strategies that have been implemented to support the deployment of broadband infrastructure and access to the digital economy. The paper draws upon a number of practical examples from a wide range of countries to deduce current information and communication technologies (ICT) investment trends and to recommend best-practice guidance for regulators wishing to foster and secure new investment opportunities. Although the sample number of case studies is not statistically representative and does not enable significant conclusions to be made, a number of themes have emerged and are summarized in this paper. In this report telecoms investments in developing markets tend to focus mainly on developing mobile infrastructure, with the aim of increasing voice, data and broadband service penetration. In contrast, mobile operators in developed markets are likely to invest in LTE networks to drive declining revenues by offering high-speed mobile data services and apps. Meanwhile, alternative and new-entrant fixed operators in developed markets are investing in gigabit broadband networks, since consumer demand is expected to increase for more online bandwidth-hungry content. Fixed and mobile network investment is also being led through market consolidation in the form of network sharing or mergers and acquisitions. The improved efficiencies and costs savings realized as a result of consolidation can be used by operators to fund network investment. Governments and policy makers can encourage investment in networks and services by creating and supporting 'tech clusters', which have the added benefit of creating jobs and growth in digital industries.

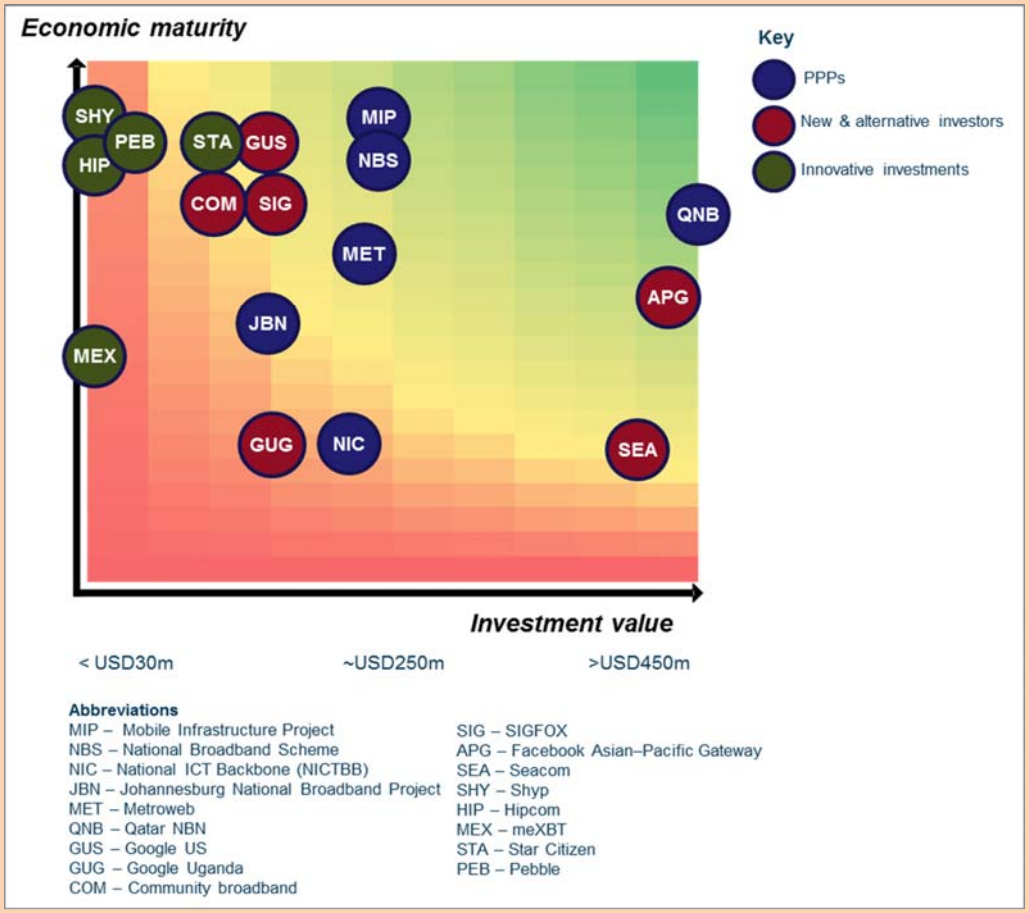
It is still common practice for government-funded broadband networks to use public–private partnerships (PPPs) in areas where it is not commercially viable for operators to invest in broadband infrastructure. There is a distinction in how PPPs projects are implemented in developing markets compared to developed markets. PPPs in developing markets are more likely to focus on building national core networks and metro rings, while PPP projects in developed markets tend to focus on increasing last-mile broadband coverage to the very last few unconnected premises, and on achieving very high broadband speeds.

Regulators can play a key role in PPP projects by encouraging infrastructure sharing, spectrum pooling, and by offering licences with coverage and performance obligations. Regulators should provide operators with existing network coverage and passive infrastructure maps to aid their network planning and ensure that operators offer effective, non-discriminatory and transparent access to dominant or government-funded networks. Detailed analysis will be required to ensure operators are not disincentivized from investing further, however. Subject to local constraints, regulators should also consider allowing incumbent operators to sell assets such as copper networks which can be used to offset future investment in broadband networks.

New market entrants such as Google, Microsoft and Facebook have all invested in broadband networks and emerging technologies. Their motivation is driven by generating revenues downstream through the take-up and usage of their content and services as a result of widespread broadband deployment. Regulators can play an important role in attracting new market entrants by providing clarity on passive infrastructure-sharing rights, working with local and national governments to promote technology pilots and supporting community broadband initiatives. They can also provide new entrants with telecoms infrastructure maps, expedite licence applications and ease 'civil' planning and construction restrictions. Governments and regulators can proactively champion pilot projects investing in disruptive technologies such as making use of TV white-space spectrum for promoting the expansion of broadband into rural areas that are not considered to be commercially feasible when using more traditional broadband technologies.

The case studies in this paper – when the value of the investment was plotted against the economic maturity of the region where the investment was made – provide an interesting insight into investment trends, shown in Figure 0.1.

Figure 0.1: Summary of investment trends



Source: Analysys Mason, 2015. Note figures are not abailable for MGTS

Investments made by new market entrants and alternative investors (technology innovators, not-for-profit investors and financial institutions such as private equity or hedge funds) tend to have a greater vertical and horizontal spread than traditional PPP investments. They are more likely to make higher-value (and therefore higher-risk) investments in broadband projects than broadband PPP investments; these investors are equally likely to invest in developed and in developing markets.

Innovative investments such as crowdfunding, digital currencies, pensions and charities are largely a phenomenon occurring in higher-layer services and in developed markets partly due to the maturity of the Internet ecosystem in developed markets which fosters technical innovation and investment. Most of these investments have initially attracted low amounts of funding – with the exception of crowdfunding – and would therefore be unsuitable for investment in significant broadband infrastructure projects. There is generally less government regulatory involvement in attracting this form of investment. However, this paper argues that governments and regulators should still be responsible for attracting inward investment and for stimulating the demand for broadband services which will drive investment in higher-layer services and connectivity. Any financial regulations being considered in growth markets should safeguard investors and consumers, enable innovation but not restrict business growth.

1 Introduction

This paper identifies strategies that have been implemented by private and public investors to support the global deployment of broadband infrastructure and access to the digital economy. Based on a review of a number of investment cases from around the world, this paper identifies best-practice investment strategies, regional and service variances and identifies key lessons for governments, regulators and investors in order to stimulate investment in broadband networks.

The purpose of the paper is not to focus on the approach followed by any single investment case, or to promote any one particular example, but rather it is to gather an overall view of the best-practice methods used to encourage investment in the digital economy. In doing so the paper highights global investments trends and considers whether there are any geographical or service variations in these trends. The paper also examines the characteristics of public–private partnership (PPP) investments and alternative and innovative approaches being used to fund investments in broadband networks and in higher-layer services and applications.

The paper has been prepared using secondary research based on publicly available information. Unfamiliar investment cases have been deliberately selected to provide a fresh perspective and familiar examples which have already been researched extensively have not been used. Needless to say, the investment cases provided do not represent an exhaustive list of examples; however they have been carefully selected to ensure that a wide a range of cases from around the world are presented so as to allow some investment trends to be identified.

Table 1.1: Case studies covered in the paper by type of investment strategy and region

Types of investment/activity	Developing regions	Developed regions
Public–private partnerships (PPPs)	• National ICT Broadband Backbone (NICTBB), Tanzania • Johannesburg Broadband Network Project (JBNP), South Africa	• Mobile Infrastructure Project (MIP), UK • National Broadband Scheme (NBS), Ireland • Metroweb, Italy • Qatar National Broadband Network (QNBN), Qatar
Alternative approaches	• Google Fiber, Uganda • Seacom, Africa • Asia–Pacific Gateway, Asia	• MGTS, Russia • Google Fiber, USA • SIGFOX, France • Community broadband, Germany
Financial innovations	• mexBT, Mexico • Aentropico, Colombia	• Star Citizen, USA • Pebble, USA • Shyp, USA • Hipcom, UK

The remainder of this document is laid out as follows:

- Section 2 provides an overview of telecoms and ICT infrastructure investment trends worldwide
- Section 3 examines the implementation of open-access initiatives and the investment approaches in broadband infrastructure projects through PPP projects
- Section 4 investigates the alternative funding approaches being used to facilitate the roll-out of broadband infrastructure
- Section 5 provides an overview of financial innovations being used to fund investments in higher-layer services and applications
- Section 6.1 summarizes the investment trends across each of the case studies reviewed in this report
- Section 6.2 provides a summary of best-practice regulatory considerations.

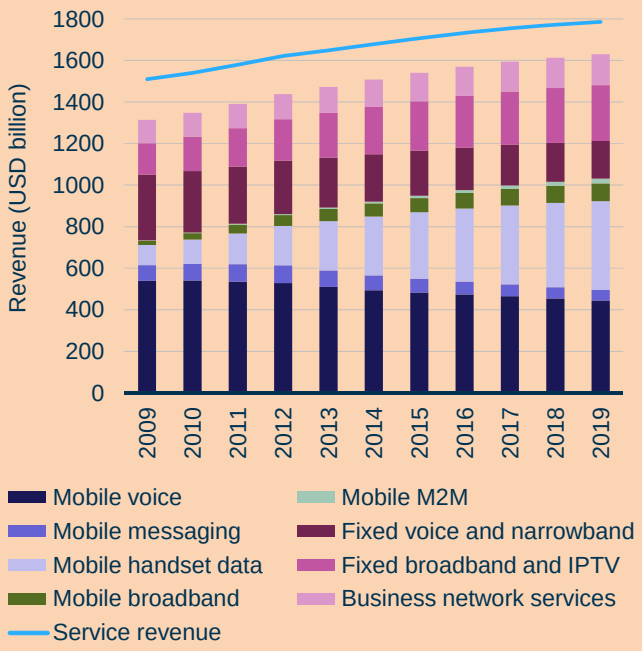
2 Global investment trends

The global telecoms market place is vast and varied, and each market is different, defined by its own unique set of macro-environment characteristics. Fixed and wireless telecoms operators and higher-layer service providers – whether in developed or developing markets – have had to adapt to local market conditions. Consequently, they have developed a range of strategies in order to remain competitive and to invest in broadband infrastructure. This section provides a summary of the investment trends being driven by operators investing in fixed and wireless broadband networks and in higher-layer services.

2.1 Investment: driving telecoms revenue growth

Operator investment in fixed and wireless networks is driving revenue growth in both developing markets and in developed markets. It is estimated that the global telecoms services market[1] will be worth USD1.79 trillion in 2019, up from an estimated USD1.68 trillion in 2014, see Figure 2.1.

Figure 2.1: Telecoms retail revenue by service type and total service revenue, worldwide



Source: Analysys Mason global telecoms market: interim forecast update 2014–2019

In developing markets – where current service availability and penetration rates for mobile broadband (e.g. 19 per cent penetration in Africa and 23 per cent in Asia and the Pacific) and fixed broadband (e.g. 0.4 per cent in Africa, 3 per cent in Arab States and 7.7 per cent in Asia and the Pacific) is low[2] – an increase in investment in 3G and (in time) LTE mobile infrastructure is expected to drive growth and increase service penetration leading to the higher revenues depicted in the figure above. Coupled with increasing GDP per capita, economies such as China, Brazil and India are expected to see the greatest revenue growth driven mainly by investment in mobile infrastructure and mobile broadband services.

In developed markets – where current service availability and penetration rates for mobile data (e.g. 64 per cent in Europe) and fixed broadband (e.g. 79 per cent of all fixed broadband connections are in Europe and in developed markets in Asia) is high – mobile operators have been making significant investments in LTE

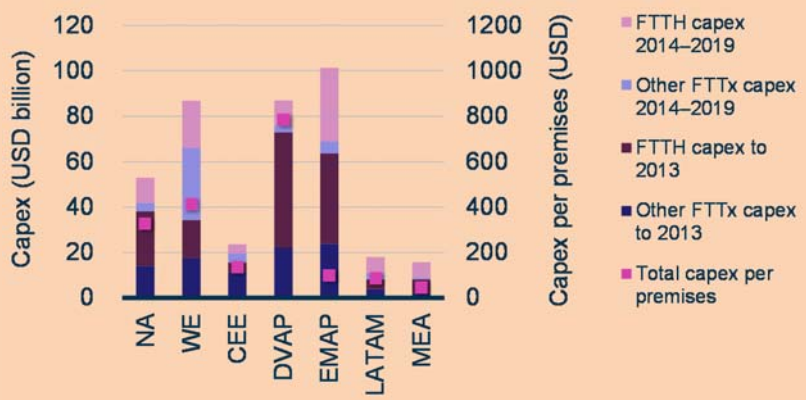
networks and offering attractive mobile data services and applications. As a result of this investment, revenue growth will come from higher consumer spend on mobile data services. Growth will be higher particularly in Japan, South Korea and the USA (which are the world leaders in terms of LTE take-up and data usage), but also in some European markets (as LTE gains traction). Incumbent and alternative fixed operators in developed markets have also been investing in fibre networks to create ultrafast broadband networks capable of speeds of up to 1Gbit/s.

The sections below discuss the fixed and wireless investment trends in some further detail.

2.2 Fixed network investment trends

Operators in developing and developed markets will be making significant investments in fixed fibre networks although the fibre technology chosen will vary. It is forecast that capital expenditure on FTTx technologies will total USD144.2 billion between 2014 and 2019. Of this, USD52.5 billion will be in Western Europe, and USD55.1 billion in developing markets (see Figure 2.2).[3] [4]

Figure 2.2: FTTx capex by region to 2019



Source: Analysys Mason FTTx roll-out and capex worldwide: forecasts and analysis 2014–2019

Note: (NA = North America, WE = Western Europe, CEE = Central and Eastern Europe, DVAP = Developed Asia–Pacific, EMAP = Emerging Asia–Pacific, LATAM = Latin America, MEA = Middle and East Africa)

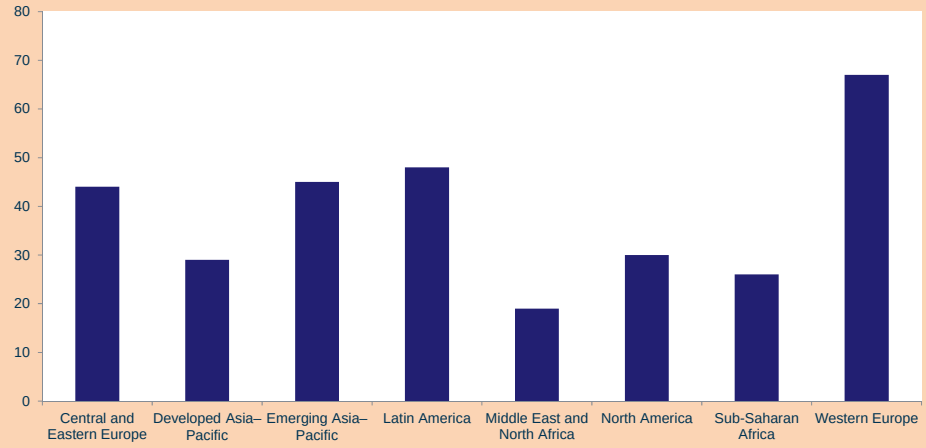
It is forecast that USD92.7 billion of this total will be spent on fibre to the home (FTTH)[5], of which USD46.2 billion will be spent in developing markets. Fibre networks appear to be favoured by fixed network operators in developing markets over copper networks. Also, the low availability of and poor quality of copper plants in developing markets can make them unsuitable for investments based on copper local loops. Fixed incumbent operators in developed markets are more likely to adopt a gradualist investment approach in order to leverage their copper network assets and introduce a mix of FTTx, and in some cases FTTH access technologies. In contrast to incumbent operators, alternative operators and new market entrants are deploying gigabit fibre networks in cities, as they are not restricted by legacy investments in copper networks. This is the case with Gigaclear and CityFibre in the UK, and Google Fibre in the USA and in Africa.

2.3 Wireless network investment trends

Mobile operators in developing and developed markets are expected to make significant investments in 3G LTE networks to leverage the growth in mobile data services. However, mobile broadband penetration in developing markets is still quite low, with a penetration level of 21 per cent in 2014. But mobile broadband is growing fast in the developing regions, where growth rates are twice as high as in developed regions[6], as

mobile operators in developing markets have started to invest in 3G networks and also more recently in LTE networks. Figure 2.3 shows that 308 operators have launched or are planning various LTE deployments worldwide; 138 of these operators are in developing markets, which forms a significant proportion of the global operator base.

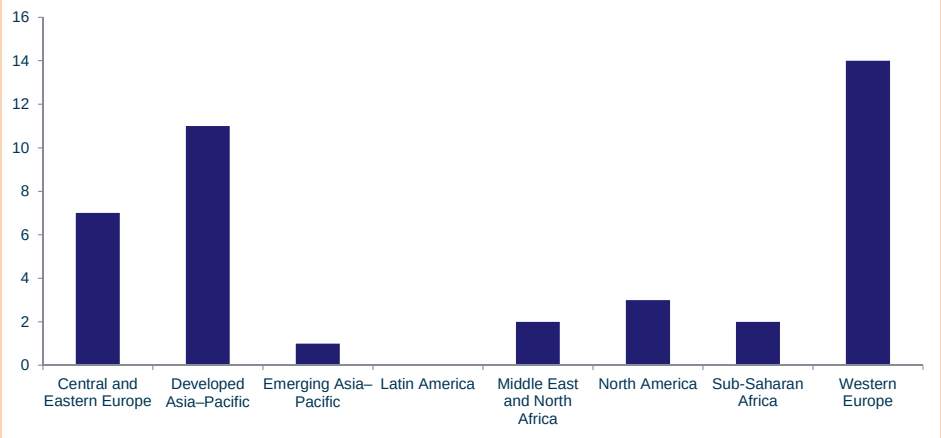
Figure 2.3: The number of operators by region that have launched or are planning LTE deployments



Source: Analysys Mason wireless networks tracker, 2015

Mobile operators in developed markets – where mobile data coverage and penetration is high – are making investments in high-speed LTE-A [7] networks. This investment is being driven by higher smartphone penetration and the take-up of services that require high-speed streaming. Figure 2.4 shows that 40 operators have launched or are planning various LTE-A deployments worldwide; 35 of these operators are in developed markets. South Korea has one of the highest LTE penetration rates worldwide (at 66 per cent of connections in 2014, expected to rise to 89 per cent by 2019).[8]

Figure 2.4: The number of operators by region that have launched or are planning LTE-A deployments



Source: Analysys Mason Wireless networks tracker, 2015

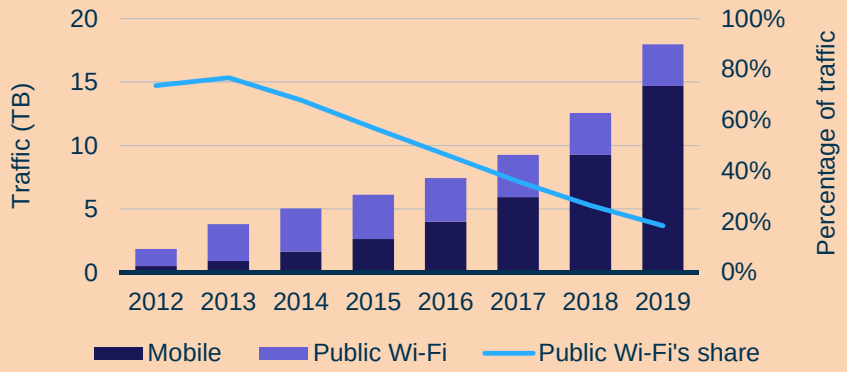
Other wireless network investments are being made by operators in public small cells, public Wi-Fi networks and in low Earth orbit (LEO) satellite broadband.

Public small cell deployments are being used by mobile operators in developed markets to address 3G and 4G network coverage and capacity issues, particularly in city business districts where the demand for data-hungry applications can be extremely high. By 2020, the Asia–Pacific region and North America will together account for 78 per cent of the investment in public small cells.[9]

Mobile players in the Arab States have been deploying small cells since 2010 to help alleviate the strain on their networks and reduce traffic congestion. In the United Arab Emirates, EITC (du) has used a combination of small cells and Wi-Fi to address peaks in data demand levels at the site of the Burj Khalifa, which attracts thousands of visitors daily. Etisalat first used femtocells in 2010. It is committed to deploying more 3G cells in public areas around the country to improve capacity. In Kuwait, Zain launched Zain Cell Access Point, a consumer-grade cell, in 2010 to improve signal coverage indoors. The device can support up to four voice calls at once and was given free to subscribers. In Bahrain, Batelco has deployed a combination of femtocells, microcells and a cell coordinated network (HetNet) to boost capacity, and it would have needed 30–50 per cent more macrocells to achieve the same capacity.

The move to invest in 4G networks and small cells, however, does not constrain the need for public Wi-Fi[10] infrastructure; in fact, the rise in consumer data consumption may drive the need for further Wi-Fi investment. Public Wi-Fi is considered a necessary service for mobile operators. Although operators that deploy public Wi-Fi networks run a small risk of cannibalizing their mobile data revenues, public Wi-Fi offers benefits for operators, such as service differentiation and increased customer retention. In fact, consumer behaviour studies have shown that people like using Wi-Fi and prefer it to mobile data in some cases. When implemented adequately, public Wi-Fi can effectively supplement mobile capacity (particularly in dense urban areas, such as business districts and shopping areas, known as public Wi-Fi offloading) and may also lead to monetization opportunities for operators. The volume of traffic offloaded onto public Wi-Fi is low even in developed markets, with high volumes of mobile traffic and strong Wi-Fi coverage. China is exceptional in terms of Wi-Fi usage – public Wi-Fi data traffic far exceeds that of mobile data, but investment in LTE is reversing this trend (see Figure 2.5).

Figure 2.5: Wireless data traffic by type and public Wi-Fi share of that traffic, China, 2012–2019



Source: Analysys Mason, 2015

Iridium and Globalstar have recently raised funds to launch a second-generation of low Earth Orbit (LEO) constellations to provide broadband and voice services. In addition, a number of satellite operators such as SpaceX and LeoSat have plans to invest in new LEO constellations designed to provide global broadband connectivity totalling an investment of around USD13 billion to USD18 billion.[11] Their plans are deemed to be commercially feasible given the lower cost of satellites and the development of the broadband market.

2.4 Market consolidation

Operator consolidation and mobile-network-sharing strategies are used by operators – mainly in developed markets – to generate efficiency gains and costs savings to fund further investments in fixed and mobile networks and in innovative services.

Scale is critical if mobile network operators (MNOs) are to compete for 4G licences, invest in mobile network infrastructure and develop innovative services in line with their competitors. Take BT's USD19 billion acquisition of mobile operator EE in the UK, for example. At first glance it would seem that the transaction is about BT expanding its market size and services portfolio to offer quadruple play. However, both BT and EE will benefit from synergies in subscriber acquisition costs (SAC) and from lower churn. There is strong evidence from other European markets that quadruple plays have this effect. However, 'in-market' mergers and acquisitions can be expensive and time consuming, and success is uncertain.

Operators in developed markets are under increasing pressure to reduce costs as revenue levels decline.. As network coverage becomes less of a competitive differentiator for operators in developed markets, they will need to consolidate networks (network sharing) as a means of redirecting their investment focus on developing innovative services rather than investing in infrastructure. One way to achieve this is to reduce the costs associated with network infrastructure. In France, Bouygues Telecom and SFR concluded a significant network-sharing agreement in February 2014, enabling the two operators to make about a 40 per cent reduction in sites. This has generated savings of about EUR100 million per year for Bouygues Telecom and EUR200 million per year for SFR.[12]

Network sharing is not constrained to developed markets. For example, eight major mobile operators in the Arab States and Africa (MEA) announced plans in March 2014 to work together on a new network-infrastructure-sharing initiative to reduce costs and to improve rural broadband coverage.[13]

2.5 Tech clusters

It is also interesting to look at how broadband investment is being encouraged by the UK government, particularly by means of the 'Tech City' initiative and through global Fintech intiatives.

Tech City is an initiative publicly endorsed by the UK government and the Mayor of London to attract investment in technology firms, creating jobs and economic growth.[14], [15] Tech City is a cluster of technology companies and supporting services firms based in East London. It has created a significant amount of tech jobs and is reported to be growing faster than other digital hubs. In the last three years TechCity has attracted investment from global markets including the US, Europe and Asia, and from investors such as Rekoo, Facebook, Google, Twitter, Amazon, Cisco, Intel, Microsoft, FourSquare and Pinterest.[16] As a result of the current attraction to and growth in the area, UK operators Openreach and Virgin Media have made announcements to invest in affordable high-speed broadband infrastructure and services in the area.[17], [18]

Other noteworthy technology investment trends include investment in 'FinTech', an industry that develops technology solutions for the finance sector. Global FinTech investment has tripled to USD12.2 billion from 2013 to 2014, creating solutions such as mobile payments, and providing easy access to finance, and reducing fraud and identity theft. These solutions and processes are all factors in the development of a mature Internet ecosystem.[19] Silicon Valley is the world leader in attracting FinTech investment, with over USD2 billion in investments in 2014. European investment totalled USD1.48 billion with the UK (mainly in London's Tech City) accounting for 42 per cent of European FinTech deals in 2014.

3 PPP investment strategies in broadband infrastructure

Telecoms operators make 'business-as-usual' investments in core, backhaul and access networks by utilizing cash piles or by raising private financing through financial markets or, as previously mentioned, through consolidation. These 'business-as-usual' investments are well rehearsed and require little regulatory or govermment intervention and are therefore not discussed in this report. However, telecoms operators can be reluctant to invest in areas where the commercial returns are uncertain. In these cases governments have intervened and entered into PPPs with operators where the government may provide funding to a private operator to invest in broadband infrastructure. This section describes these PPP investment strategies, using case studies to describe the key characteristics of each of these approaches.

3.1 Overview of PPPs

A study on financing broadband networks and PPPs has previously been undertaken for the European Commission[20] and the ITU[21] that broadly defined PPP[22] and identified investment models commonly used by broadband PPP projects. The investment models and funding approaches examined in these reports remain by far the most common approaches to implementing broadband networks.

Most PPP projects in broadband infrastructure tend to fall into one of the following funding model categories:

- **private design, build and operate (DBO)** – where a private operator retains ownership and control of the broadband network. The private operator may benefit from receiving state funds to invest in broadband infrastructure in commercially unviable areas.
- **public outsourcing** – where a private operator has responsibility for running a network under a government-funded contract. The government normally retains ownership of the network after the contract expires.
- **joint venture (JV)** – where a special purpose vehicle (SPV) or separate legal entitiy is created by the private operator and the government to invest in broadband infrastructure in commercially unviable areas. Funding, network ownership and day-to-day management responsibility is shared by the private operator and the government.
- **public DBO** – where the government has full funding responsibility and has full ownership of the network assets. Elements of the day-to-day running may be allocated to private contractors.

The report also identified common funding sources for broadband projects. These included government grants, universal service funding and external funding from non-governmental organizations (NGOs) and international development banks. Note that the 'bottom-up' model has been excluded from the list of the most common investment models. This approach involves communities driving the investment process and it is described in more detail in Section 4, where alternative investment approaches are discussed.

The four above-mentioned models involve variations on a mix of public- and private-sector intervention. Each model's approach varies based on three main characteristics, i.e. i) the funding source for the roll-out and operations of the infrastructure; ii) responsibility for the deployment of the infrastructure and running operations; iii) ownership of the infrastructure (see Table 3.1).

The most suitable investment approach for a particular project can depend on a range of variables including the market structure, level of Internet maturity and the political landscape. The government's experience in funding, owning and running broadband networks is also an important consideration when deciding which investment approach should be taken. The key advantages and disadvantages of the investment approaches are summarized in the sections below. At least one case study is inlcuded in each section for each type of PPP investment approach, which provides details on the role of the regulator in attracting broadband infrastructure investment, and also list key lessons to be taken from each project.

Table 3.1: Key characteristics of investment approaches

Investment approach	Funding source	Deployment and operations of infrastructure	Ownership of infrastructure	Case study
Private DBO	Public and private sectors	Private sector	Private sector	• Mobile Infrastructure Project (MIP), UK • National Broadband Scheme (NBS), Ireland
Public outsourcing	Public sector	Private sector	Public sector	• National ICT Broadband Backbone (NICTBB), Tanzania • Johannesburg Broadband Network Project (JBNP), South Africa
JV	Public and private sectors	Public and private sectors	Public and private sectors	• Metroweb, Italy
Public DBO	Public sector	Public and private sectors	Public sector	• Qatar National Broadband Network (QNBN), Qatar
Source: Analysys Mason, 2015				

3.2 Private DBO

In this investment model the private sector (usually a network operator) designs, builds and operates the broadband infrastructure on behalf of the government. The infrastructure is typically made available to other service providers and Internet service providers (ISPs) on a wholesale and open-access basis. It should be noted, however, that the infrastructure remains under the network operator's ownership and does not transfer to the government.

In this approach government intervention is limited to funding and the private operator retains control over the design of the networks and retains the network assets. The advantage of this approach is that the public sector has limited responsibility and does not have to manage the infrastructure, minimizing its exposure to risk. The private company benefits from the ownership of the infrastructure and minimal government interference. This approach can also be seen as the least complex of the other PPP models as it does not involve the creation of overly complex PPP structures.

There are disadvantages to this approach. Governments have little influence over or control of the network design, build and roll-out strategy, despite funding the network build. The social benefit of the infrastructure may be limited as private operators may be more focused on financial returns than on social investment.

To make the investment case more appealing for operators in commercially unviable areas, the government may provide a grant fund to part-subsidize the cost of building the broadband infrastructure. In return for the subsidy, the government would expect a significant financial contribution from the network operator. The government would also apply strict controls in return for the grant fund; for example, these would

include the setting of roll-out, network quality and take-up targets. In Europe, State-aid mandated 'claw-back rules' prevent the network operator from making excessive profits.

This approach of setting controls ensures that the network operator has a strong financial incentive to construct the network to the required technical standards. In addition, it incentivizes the network operator to achieve the take-up targets set by the government, by stimulating demand and setting reasonable wholesale prices. Therefore much of the operational risk lies with the network operator.

This approach assumes that the network operator is able to build a high-speed broadband network and that it is sympathetic to the concept of operating a wholesale network on an open-access and non-discriminatory basis. Despite no government ownership, monitoring and due diligence by the government are critical in achieving value for money and an effective outcome from this approach. A private DBO is unlikely to make use of state assets in preference to using and building its own assets.

Table 3.2: Selected examples of private DBOs

Name of private DBO	Description
Mobile Infrastructure Project (MIP) (UK)[23]	UK government programme that aims to improve mobile coverage in remote areas by 2016. (See case study below)
Superfast Cornwall (UK)[24]	Project that leverages the resources and expertise of an established operator (BT) to deliver a large and complex project
NGB Wales (Wales)[25]	Grant-funded government intervention has been used to increase the availability of next-generation access (NGA) broadband coverage in rural areas across Wales
InfraCo (Nigeria)[26]	The core tasks of InfraCo will be to build, operate and maintain the fibre-optic communication network, and to lease fibre-optic connections to operators and other companies, as well as to the public
National Broadband Initiative (Malaysia)[27]	This initiative is rolling out high-speed broadband infrastructure through a PPP agreement with Telekom Malaysia Berhad (TM)
Telebras (Brazil)[28]	Telebras, the previously dormant incumbent operator, was re-established in 2007 in order to provide wholesale services to service providers over its backbone network
Rural Broadband Initiative (New Zealand)[29]	This JV between Vodafone and Telecom New Zealand for rural network roll-out is subsidized through a government grant
Mobile network sharing (Sweden)[30]	Mobile operators have entered into a network-sharing agreement to reduce their costs and to help achieve the regulator's coverage obligations
Source: Analysys Mason, 2015	

Two examples of private DBOs are set out in greater detail below.

3.2.1 Case study: Mobile Infrastructure Project (MIP), UK

This case study was chosen since it approached the problem of solving mobile 'not-spots' from a very unique perspective, in that it has funded the build of passive mobile infrastructure in a very tightly regulated UK market.

MIP was initiated by the UK Government in 2011 in order to improve mobile coverage to remote and rural areas within the UK which had either little or no mobile coverage.

Some areas of the UK do not get good quality mobile coverage from mobile operators, or do not get any coverage at all. In some areas, especially remote and rural areas, it might not be cost-effective for mobile operators to provide coverage, as the low subscriber numbers and low subscriber density does not justify investment in mobile infrastructure. These areas are referred to as 'not-spots' and are the primary area of focus for MIP.

The project itself was delivered by a government delivery vehicle named Broadband Delivery UK (BDUK) and the objectives of MIP were to:

- improve the coverage and quality of mobile network services for the 5 to 10 per cent of consumers and businesses that live and work in areas of the UK where existing mobile network coverage is poor or non-existent
- extend coverage to 99 per cent of the UK population.

A GBP150 million capital fund was set aside by the UK government to fund the construction of new masts (passive infrastructure only).[31] The masts, which would be made available to all mobile operators on a wholesale open-access basis, would allow operators to install their own active equipment and offer 2G, 3G or 4G connectivity to end users. The operators would be reponsible for funding their own operating costs.

MIP was funded through a private DBO arrangement. Arqiva, a significant UK infrastructure provider, was awarded the contract to design, build and operate the masts following a competitive procurement. As a result much of the design and planning responsibility was left in the hands of the private sector. However, as MIP was being funded by the state, it was required to gain State-aid clearance from the European Commission in December 2012, which confirmed that the project was compatible with the rules of the single market.

MIP was expected to have connected an additional 60 000 premises out of 80 000 known 'not-spots' by the end of 2013. However, the project has been subject to a number of delays and is not expected to complete until March 2016 – it was originally expected to finish in 2015. The first site went live in September 2013, with little progress made in 2014.[32] By December 2014, only two sites out of potentially several hundred sites had reportedly gone live.

The delays can be put down to a number of reasons:

- it is alleged that Arqiva has not provided the industry with detailed roll-out plans or timescales for the development of the mast sites
- some of the sites have had to undergo lengthy consultation processes to get the necessary planning approvals for the construction of the masts
- there have been technical challenges in getting adequate power supply (3-phase electricity) to some of the most remote sites
- it is challenging to secure backhaul circuits to connect to some of the most remote sites.

The UK telecoms regulator, Ofcom, played an important role in identifying the location of not-spots and is continuing to support the government in delivering MIP.[33] It is too early to tell whether MIP has been successful overall and in particular in eradicating 'not-spots'. However, what is clear is that a project of this scale is not without its challenges and requires significant upfront detailed planning, coordination and stakeholder management. The key lessons and take-aways have been summarized below.

Key lessons: Mobile Infrastructure Project (MIP)

- The UK telecoms regulator Ofcom, played an important role in identifying the location of not-spots and is continuing to support the government in delivering MIP
- The award of State funds to develop broadband infrastructure should require telecoms operators to share their network infrastructure on a wholesale basis to promote competition and reduce costs
- Government interventions should be aimed at funding the construction of passive infrastructure in areas where there was no competing infrastructure. Adopting these key principles was a vital factor in receiving State-aid clearance for the project
- Amendments to legislation and regulation involving the deployment of networks can reduce 'red tape' and speed up delivery
- Stakeholder communications are vital in ensuring all industry players are familiar with the design plans for the project, allowing MNOs to coordinate their own radio planning and service delivery plans
- Private operators should work closer with the industry and key stakeholders to anticipate and overcome the technical challenges of providing power and communications before they become an issue
- A competitive tendering process will ensure that the government achieves a solution that both meets its technical requirements and represents value for money for its citizens
- A single coordinated national roll-out (as opposed to a patchwork of broadband networks) can create implementation synergies, thus reducing the government's overall funding requirement

3.2.2 Case study: National Broadband Scheme (NBS), Ireland

This PPP project was chosen as it was one of the early schemes to use private DBO to improve basic broadband connectivity in rural areas; the fact that it has been fully implemented provides many useful lessons. The project also awarded a contract to a mobile provider rather than a fixed provider, which can provide useful insights to regulators and governments in developing markets where mobile services are more popular than fixed services.

NBS was designed to address the digital divide in Ireland. In 2007, it was estimated that 10 per cent of the population resided in areas where it was not economically feasible for providers to offer services. The NBS scheme was launched in 2008 by the Department of Communications, Energy and Natural Resources (DCENR) to improve the delivery of basic, affordable broadband to certain target areas in Ireland in which broadband services were deemed to be insufficient. These areas were categorized as the NBS Coverage Area. Any fixed residential or business customer located within the designated NBS Coverage Area was eligible to apply for broadband services under the NBS. Approximately 234 000 premises were located within the NBS Coverage Area.[34]

The project cost is EUR223 million,[35] of which the Irish Government made a contribution of EUR80 million. NBS was set up as a private DBO following the conclusion of a competitive tendering process in 2008 which resulted in a contract being awarded to Three (a Hutchison Whampoa company), to design, build and operate the NBS.

Under the NBS contract, Three was required to provide basic broadband services to residents and businesses within the NBS Coverage Area for the duration of the five-year contract. The NBS scheme ended in August 2014 following a 68-month operational period which was limited in duration to ensure compliance with EU State-aid rules. The contract required Three to build mobile infrastructure to provide services at both a wholesale and retail level.

In order to facilitate competition in the area, Three was also required to provide wholesale access to all other authorized operators who wished to serve premises in the NBS Coverage Area. Following the expiry of the scheme, Three is no longer required to make the NBS retail and wholesale services available under the NBS contract, and broadband coverage will continue to be available throughout the NBS areas on a commercial basis.

In 2010, the government announced that it had met the EU target for broadband availability two years ahead of schedule and that broadband coverage was available to 235 000 premises in 1 028 areas (99 per cent of premises) across the country. A separate Rural Broadband Scheme was launched to target the remaining 1 per cent of premises.

A study carried out shows that the spin-off benefits of widespread broadband access can be significant in regional areas. The study estimates that in Donegal, the Scheme will deliver EUR25 million to the local economy, EUR53 million in Galway, EUR40 million in Kerry and EUR26.9 million in Mayo.[36]

The NBS seems to have been a success in Ireland. In 2007, households in Ireland with a broadband connection stood at 31.2 per cent, which was below the EU average of 42.4 per cent. In 2014, households in Ireland with a broadband connection stood at 79.5 per cent, which was above the EU average of 78.3 per cent. Specifically, it is clear that Ireland has a higher percentage of mobile broadband connections than the European Union average as a direct result of the NBS.[37]

Key lessons: National Broadband Scheme (NBS)

- Three was required to offer a wholesale service to other operators on a non-discriminatory basis at an appropriate tariff to ensure compliance with EU State-aid rules
- Once-off state funding is useful to get infrastructure and services into areas that are not economically feasible
- Time-limited interventions can ensure that the retail market has an opportunity to participate in competitive service provision once the intervention period has expired
- More than one intervention scheme may be required to achieve 100 per cent broadband coverage aspirations
- The definition of a coverage area by the number of premises and by region can assist operators in understanding the scope and scale of the intervention

3.3 Public outsourcing

This approach involves the government awarding a contract to a private-sector firm to construct and operate a broadband network on behalf of the government. The government typically funds the entire network and the infrastructure remains in government ownership.

The private sector is normally awarded a contract (after a competitive tender) to construct and operate a wholesale open-access network. It may also be required to market the wholesale services to other ISPs, and in some cases to offer retail broadband services as well. Contracts typically last between 10 and 15 years, after which a competitively procured contractor may be appointed to operate the network.

Most if not all funding for this approach will need to come from the public sector. Unlike the private DBO and JV investment models, the private sector does not make any financial investment in a public outsourcing deal. Instead, the private sector constructs the broadband infrastructure and operates the broadband network on behalf of the government, in return for payments at pre-agreed milestones.

Under this model the government is fully responsible for financing the broadband infrastructure and therefore accepts much of the financial risk. However, this approach does allow the government to have greater responsibility and control over the design of the network and in setting the network's technical- and service-performance criteria. Typically the government will be able to define clear performance

milestones for the private sector to meet (such as network roll-out timescales, take-up and service levels), to be included in the contractual terms. Failure to meet these terms may result in the private sector incurring fines or penalties.

Table 3.3: Selected examples of public outsourcing

Name of private DBO	Description
National ICT Broadband Backbone (NICTBB), Tanzania[38]	National core fibre network built across Tanzania. (See case study below)
City of Johannesburg Broadband Network Project (South Africa)[39]	Fibre network operated across Johannesburg by the government. However, in a recent development the city cancelled the contract and is proposing to convert it into a public DBO. (See case study below)
Auvergne (France)[40]	This model leverages the expertise of the private sector, while ownership remains in the public sector. The private operator receives an income to run the network for ten years
Metropolitan Area Networks (Ireland)[41]	Sells open-access active and passive wholesale services to operators in areas that do not have adequate private-sector broadband provision
Shetland SHEFA 2 Interconnect Project (Scotland)[42]	This project aims to provide adequate backhaul network in the Shetland Islands in areas where such infrastructure is currently unavailable
South Yorkshire (UK)[43]:	Local authorities invested in an FTTC network, with a partnership arrangement for network management. (However, this initiative is no longer running and has reverted to a private DBO)
DORSAL (France)[44]	Collection of local authorities invested in network backbone, DSL and WiMAX services
Project Isizwe municipal Wi-Fi (South Africa)[45]	Private firm Project Isizwe is being contracted by several municipalities to deploy Wi-Fi hotspots in public buildings and schools
Western Cape Government broadband (South Africa)[46]	The Western Cape Government has outsourced the deployment and management of a network connecting all provincial government buildings to Neotel.
Source: Analysys Mason, 2015	

Two examples of private DBOs are set out in greater detail below.

3.3.1 Case study: National ICT Broadband Backbone (NICTBB), Tanzania

This case study will be of interest to regulators and governments that are currently construcing national fibre backbone networks to facilitate the roll-out of broadband connectivity and wider e-Enabling initiatives.

The NICTBB is a fibre network being built by the Government of Tanzania in order to enhance the usage of ICT applications and promote the development of e-government, e-learning, e-health and e-commerce. The NICTBB is broadly intended to achieve the following objectives:

- provide international connectivity to all landlocked neighbouring countries
- establish points of presence (PoPs) across all of Tanzania's administrative districts
- provide all licensed operators with equal access to the fibre network to stimulate competition
- enable the provision of affordable Internet to Tanzanians

- increase the usage of ICT
- facilitate the implementation of e-government initiatives.

The NICTBB is managed and operated by the incumbent fixed operator Tanzania Telecommunications Company Limited (TTCL) on behalf of the government. It should be noted that the NICTBB has a completely independent network from that of TTCL's network. The USD200 million project is being funded by the International Telecommunication Construction Corporation (CITCC) of China at the cost of USD170 million – mainly thanks to a soft loan provided by Chinese Exim Bank[47] and with the USD30 million from the Tanzanian Government. With the support of the loan, the Tanzanian Government deployed a fibre cable on the rail, electricity and gas networks in 2010 and pooled this fibre into a single SPV, the NICTBB.

The NICTBB provides high-capacity long-distance wholesale capacity to fixed and mobile operators and ISPs as well as providing access to international submarine fibre connectivity. The establishment of PoPs across Tanzania allows operators to connect their last-mile networks to a national backhaul network. NICTBB's network spans between major towns and cities across Tanzania and extends to all the borders of the neighbouring countries. The NICTBB has also been connected to the two East Coast submarine cables (EASSY and SEACOM) landing at Dar es Salaam.

NICTBB operates from open-access PoPs in all major towns and cities. Most of the NICTBB equipment has been accommodated in TTCL buildings; therefore operators can access carrier-class hosting and bandwidth services.

The NICTBB has been implemented in phases, with 31 PoPs currently operational. By the end of 2014, NICTBB spanned 7 560km across 24 regions. It has reached all border points and achieved a USD6.7 million contract to provide bandwidth to Rwanda over the next ten years. Third-party research has found that there have been improvements in the provision of e-commerce, m-commerce, e-banking, e-education and e-government since the NICTCBB commenced operations.[48] These improvements have enabled Tanzanians who were otherwise digitally excluded to become proficient in using e-services, which has accelerated Tanzania's economic development.

However, fixed broadband penetration is still very low in Tanzania, standing at only 0.1 per cent of the population at June 2014. This is due to the fact that coverage of fixed broadband metro and access networks is limited. Mobile penetration is still low in Tanzania, standing at 60.1 per cent at the end of 1H 2014, leaving room for continued growth.[49] Improved coverage, especially in rural areas, has helped to make mobile services more accessible. The government awarded contracts to TTCL in February 2014 and Vodacom in April 2014 to expand coverage to underserved areas, and supported them with the universal access fund. The telecoms regulator has also contributed to improving the affordability of mobile services by introducing mobile termination rate (MTR) cuts in March 2013.

Key lessons: National ICT Broadband Backbone (NICTBB)

- NICTBB is operated and managed by TTCL on a transparent and open-access basis. It is operated separately to the rest of TTCL's business. This separation and the provision of transparent and open-access connectivity is essential in ensuring service providers are not adversely affected by the government's intervention in infrastructure
- Other regulatory measures, such as cuts in MTR rates in conjunction with broadband interventions, may be necessary to stimulate growth in mobile services
- Infrastructure intervention backed by a strong business case and development agenda can attract significant development funding or loans
- National backbone networks are not a means to an end. Further investment in metro networks and access networks will still be required to deliver last-mile connectivity to end users
- The lack of specific and defined outcomes makes it difficult to measure the true success of an intervention or investment
- Allocating universal service funds to competing operators can stimulate competition in the development of rural broadband networks

3.3.2 Case study: Johannesburg Broadband Network Project (JBNP), South Africa

This case study has been selected because it provides useful insights into a public outsourcing project that has – for a number of reasons – become a public DBO project. The Johannesburg municipal government took control of the project when contracts with private contractors were terminated.

In 2006, the JBNP was conceived by the City of Johannesburg (CoJ) municipal government in order to address digital exclusion issues and to improve use of digital connectivity among Johannesburg's citizens and businesses. The JBNP's vision was to become a Smart City and it was expected that the JBNP would develop economic growth through the creation of business opportunities, by providing access to public services and increasing employment opportunities for youths.

To realize its vision, CoJ awarded a contract to Ericsson – which was then ceded to CitiConnect Communications – to build a fibre network that would extend coverage across the City's business and residential premises. The fibre network was estimated to be 900km in length.[50] The principle behind this network was to provide businesses and residents with broadband and ICT services at lower cost than was available by enabling service providers to access wholesale capacity from the JBNP on an open-access basis. This in turn would allow service providers to provide end users with low-cost retail services. The CoJ would also act as an anchor client connecting its buildings to the JBNP, however this would only account for a small percentage of network capacity.

The investment was estimated to be around USD100 million in capital with management costs expected to be around USD24 million per annum. The contract was constructed along the lines of a public outsourcing model; after 12 years, Ericsson would return responsibility for the operation of the network back to CoJ.[51]

The network build was expected to go live in 2013; however in 2014 the CoJ terminated the contract with CitiConnect Communications, supposedly on the basis that CitiConnect Communications had breached the agreement, a claim which the latter disputed. The CoJ paid around USD93 million to Ericsson for the infrastructure that had been built to date and in February 2015,[52] the CoJ took responsibility to complete the network build. It is now a public DBO project, meaning that the infrastructure is fully owned and operated by the municipality.

The project has come under scrutiny from independent analysts and politicians who have questioned the need for a municipally owned fibre network. Questions have also been raised about the ability of CoJ to compete with commercial service providers to generate profitable returns. There have been calls for the CoJ to sell the network to private service providers.

Key lessons: Johannesburg Broadband Network Project (JBNP)

- Governments should undertake an extensive market assessment prior to undertaking a broadband intervention to ensure there is a clear market failure that justifies the intervention. In this case a number of alternative fibre networks are already available in Johannesburg, which has called the validity of the project into question
- Contractual obligations upon the public and private sector should be clear at the outset to ensure there is no dispute in the event that either party defaults on the contractual agreements
- Public DBOs should be limited to offering wholesale services on a non-discriminatory and open-access basis to ensure competition is not adversely affected

3.4 Joint venture (JV)

This model assumes a split in ownership between the private sector (typically one or more network operators) and the government. The network operator takes responsibility for the design, build and operation of the broadband network infrastructure. The network infrastructure is typically made available to other service providers and ISPs on a wholesale and open-access basis. The infrastructure remains part-owned by the network operator and the government.

Public-sector funding is required for a JV, but funding is shared with private-sector partners. Much of the initial financial contribution to fund the network build typically comes from the government, to make it attractive to the private sector. The costs of deploying the network infrastructure, associated systems and processes and the ongoing administration of the JV are shared. The exact amount of private- and public-sector capital investment has to be agreed, based on how rewards and risks are shared.

The government takes on greater financial risk with this approach; however, it is able to control the initial stages of the design and construction of the network. Meanwhile the private sector takes on greater responsibility once the project becomes self-financing.

Depending on the terms agreed for the JV the government may retain its ownership in the venture or it may divest its shareholding in order to recoup some of its early investment.

JVs can vary widely, since they need to take account of local tax considerations and the extent to which the government wants to hold shares and voting rights. Examples of JVs are very limited, possibly because they are complicted to set up.

Table 3.4: Selected examples of JVs

Name of private DBO	Description
Metroweb (Italy)[53]	Ownership of the network is split between the public and private sectors by setting up an SPV. (See case study below)
Banda Ultralarga in Lombardia (Italy)[54]	A JV approach enables the government to secure expertise and financing while maintaining public control over the scope of the project
Eastern Corridor (Ghana)[55]	The Ghana Ministry of Communications, in partnership with Alcatel–Lucent, has planned a 800km fibre-optic network in the Eastern Corridor
Kenya LTE[56]	This PPP has been proposed to deliver a national broadband LTE network in Kenya
Source: Analysys Mason, 2015	

An example of a JV is described in greater detail below.

3.4.1 Case study: Metroweb, Italy

This case study – although covered in previous ITU reports – has been selected as it resulted in an infrastructure fund manager acquiring a controlling stake. Metroweb has also recently become the subject of a takeover battle between leading operators in Italy, attracting significant private-sector interest.

Prime Minister Matteo Renzi has an ambitious plan to bring super-fast broadband to 85 per cent of Italy's consumers by 2020. Fixed broadband take-up in Italy is 23 per cent compared to an EU average of 31 per cent and the share of fixed broadband download speeds (greater than 30Mbit/s) are significantly below the EU average of 23 per cent, at just 2 per cent.[57] Metroweb, which generates sales of just USD74 million is seen by the Prime Minister as the right vehicle to achieve his ambitious plans.

Metroweb is an example of a SPV where ownership of the network is split between the public and private sector. It was conceived as a result of Telecom Italia's (the incumbent operator) lack of investment in fibre infrastructure. It is an arrangement between the local gas and electricity utility company A2A and e.Biscom, a new telecoms service provider, to accelerate the roll-out of a large metropolitan fibre network.

Metroweb's mission is to deploy fibre-optic access networks (ducts and cables) in the major metro areas. Metroweb owns a 3 200km fibre network extending almost across the whole municipality of Milan and Northern Italy. Metroweb is a passive infrastructure operator and leases point-to-point dark-fibre service to its customers. Metroweb's main customer is Fastweb (its separate retail arm), but it also serves Telecom Italia, Wind, Vodafone and other service providers in Milan.

As of April 2015, Metroweb is planning to expand its fibre-optic network to two Italian cities, having agreed a EUR100 million loan with two Italian banks.[58] The company will select the metropolitan areas with the greatest housing density among a shortlist including Florence, Parma, Verona, Brescia and Monza. The company has recently expanded its fibre-optic network to Turin and Bologna in separate investments of around EUR125 million and EUR62 million.[59] Although Metroweb is central to the government's broadband aspirations, it has not gained from any State-aid approved funding. However, local municipalities (such as the one in Bologna) have played a key role in creating favourable conditions to attract investment from Metroweb by:

- creating a register of all current network infrastructure in the City
- speeding up the process of getting the necessary planning permits to carry out civil work.

Italian infrastructure fund F2i acquired a 53.8 per cent stake in Metroweb in 2011, as it expecting a growing demand for high-capacity broadband and services such as those provided by Metroweb. It is now looking to divest all or part of its holding. Consequently Telecom Italia and Vodafone have become interested in acquiring Metroweb's national high-speed fibre network. On 13 January 2015 a meeting was held between

F2i and Vodafone to reportedly discuss the possible sale of a controlling stake in Metroweb. The firm is valued at around EUR400 million.[60]

Key lessons: Metroweb

- It is possible to create a public–private SPV without direct funding from the government or without any State-aid or public funds
- Municipalities can play a key role in attracting private-sector investment by reducing bureaucracy and making relevant data available
- Metroweb operates separately to its retail arm (Fastweb), enabling it to offer wholesale services to other service providers. This approach also allows the SPV to generate income from more than one service provider funding immediate cashflow requirements
- SPVs can access commercial financing to fund network expansion just like any other commercial operator
- Public–private SPVs can be acquired by private investment funds. This arrangement has likely attracted further interest in Metroweb from private operators, in the same way that they would approach any other commercial deal

3.5 Public DBO

The public DBO investment model is an extension of the public outsourcing model and requires the greatest level of involvement and financial contribution from the government, and minimizes private sector involvement and investment. This model is used as an intervention method when it is not possible to attract any interest from the private sector. The government typically funds the entire network construction and the infrastructure remains in government ownership.

Public DBO projects work in much the same way as public outsourcing; a private-sector contractor is awarded a contract to design and build the network infrastructure on behalf of the government. However, the government creates a separate public-owned company which has responsibility for management and operation of the broadband network, so the main difference from public outsourcing is in the operation of the network, rather than its construction. The public-owned company takes full responsibility for making the wholesale open-access network available to other service providers on a competitive and open-access basis.

In the case of this model the government is fully responsible for financing the broadband infrastructure and therefore takes on much of the financial risk. The government also takes on additional operational risk compared to the risk inherent in other investment models. However, as with the public DBO this approach allows the government to have greater responsibility and control over the design of the network and in setting the network's technical and service performance criteria. Having ownership control may allow the government to re-use assets from SOCs, providing they are fit for purpose.

It should be noted that the public-owned company will be responsible for meeting the performance milestones, whereas under the private DBO model this is the responsibility of the private sector.

Table 3.5: Selected examples of public DBOs

Name of private DBO	Description
Qatar National Broadband Network (QNBN) (Qatar)[61]	A private company owned by the government of Qatar with responsibility to roll out passive fibre infrastructure across the country. (See case study below)
NBNCo (Australia)[62]	An SPV (NBNCo) was created to leverage Telstra's infrastructure to address rural and urban needs
Asturcon (Spain)[63]	A 100 per cent public-owned and public-run network in an area requiring economic regeneration; Asturcon has attracted a national operator (Orange)
Stokab (Sweden)[64]	A municipality-owned, city-based dark-fibre meshed network
Midtsoenderjylland (Denmark)[65]	A municipality-owned investment in fibre connectivity between city halls to provide FTTH, in partnership with the local electricity company
Piemonte (Italy)[66]	Piemonte is managed by a public ICT administration organization investing in multiple infrastructures to stimulate private investment
Alto Adige (Italy)[67]	Alto Adige is managed by a local council to provide wireless connections to homes and fibre connections to the public sector and businesses
RAIN (Lithuania)[68]	RAIN is managed by a non-profit-making public enterprise investing in a nationwide backhaul/core network.
Source: Analysys Mason, 2015	

Below we describe an example of a public DBO in greater detail.

3.5.1 Case study: Qatar National Broadband Network (QNBN), Qatar

This case study is a recent example of how a government-funded private company can be used to facilitate the roll-out of passive fibre infrastructure, and work with the private sector to reduce infrastructure costs.

Qatar has among the highest broadband penetrations in the world, however it lags significantly behind leading nations in terms of speed, with current maximum speeds of only 8 Mbit/s. In 2011 the Qatari government established QNBN with a mandate to roll out a nationwide, open-access high-speed broadband FTTH network after it was awarded a 25-year licence by the Telecom Regulatory Authority, Qatar. QNBN was formed as a result of Qatar's ambitious digital plans, which are summarized under the Qatar ICT Strategy 2015 and further articulated through the Qatar National Vision 2030. The aim is to become one of the most well-connected countries on earth with respect to broadband.

The QNBN network will have nationwide fibre coverage and will provide wholesale services to service providers. In 2012 Ericsson was selected by QNBN to deploy the fibre network. QNBN will retain ownership of the fibre network and maintain responsibility for managing and running the network, hence it is classified as a public DBO. The network is expected to cover 95 per cent of the households in Qatar by 2015 and 100 per cent of the business establishments in Doha by 2015, equating to approximately 260 000 connections by 2015.[69] QNBN will focus solely on the deployment of a passive network infrastructure, leveraging existing and new infrastructure in Qatar to maximize efficiency and cost-effectiveness.

According to QNBN typical investors would not be attracted to invest in passive infrastructure because the return on investment is not that high. As a result the government has invested around USD500 million in capital expenditure to overcome these bottlenecks.

In 2011 QNBN signed an Infrastructure Access Agreement (IAA) with service provider Qtel to reduce QNBN civil infrastructure build costs. Under the agreement Qtel will supply QNBN with duct network access and access to other passive telecoms infrastructure over the next 20 years.[70] However, Ooredoo, which dominates the fixed broadband market, is aggressively laying fibre to replace its copper network. It appears that it is continuing to deploy its FTTH network in parallel with QNBN's fibre roll-out. Ooredoo seems to not be giving QNBN access to its fibre network despite repeated attempts from the regulator to force Ooredoo to do so. Ooredoo's lack of cooperation and roll-out delays are hindering the government's plans for nationwide fibre coverage by 2015. The regulator may need to consider a more severe form of intervention to ensure Ooredoo's cooperation.

In 2012 QNBN signed an interim wholesale agreement with Vodafone Qatar,[71] to enable it to use the QNBN network to deliver telecoms services to end users. Vodafone Qatar has deployed very limited fixed infrastructure to date, and relies on QNBN's network outside its original market of the Pearl district. Because of QNBN's slow progress, Vodafone might consider alternatives to offer fast broadband services to it customers by, for instance, lobbying the regulator to force Ooredoo to give access to its passive infrastructure.

QNBN began to roll out fibre infrastructure in Barwa City and Barwa Commercial Avenue in August 2012. It was not until 2013 that it announced the opening of two central offices to serve 30 000 businesses and residences in the West Bay area (the business district) of Doha. The delay has been partly caused by operational complexities in the network roll-out – in particular when re-using Ooredoo's civil infrastructure. At the same time, Ooredoo is continuing to deploy its own fibre infrastructure, regardless of QNBN's mandate. In the meantime QNBN has connected a number of government ministries through point-to-point fibre connectivity, enabling the ministries to benefit from secure high-speed broadband networks.

In 2014, Vodafone Qatar reached a non-binding agreement to buy 100 per cent of NBN for QAR210 million (USD58 million).[72] However, this was scrapped following a due diligence and negotiation process and QNBN is continuing with is build-out strategy.

Key lessons: Qatar National Broadband Network (QNBN)

- QNBN was granted a licence to offer wholesale services on an open, equal and non-discriminatory basis and a mandate to set appropriate national wholesale prices to enable downstream (retail) competion
- Government funding of fibre networks can be used to reduce the investment required to be made by private operators, therefore attracting private sector interest in the network
- Re-using existing passive infrastructure may reduce civil infrastructure build costs. However, dominant operators should be required to provide open access to their networks
- By continuing to roll out FTTH aggressively, alternative operators (in this case Ooredoo) might contribute to fulfilling the broadband vision in a different way than initially expected – in this case independently of QNBN. This would mean putting the government intervention at risk and Qatar might end up with two separate fibre networks. These risks must be taken into account prior to initiating an intervention project
- Operators should be consulted in advance to understand their roll-out plans; doing so may avert the risk of duplicating fibre networks
- National broadband networks can be considered for sale to the private sector subject to regulatory approval and commercial due diligence. However, in this case, Vodafone's proposed deal might have run against the original remit of QNBN, which was to rent wholesale fibre capacity to Vodafone Qatar and its rival Ooredoo, limiting competition further downstream

3.6 PPP implementation strategies

The PPP investment strategies and models descibed in the previous section are still commonly used by operators and governments (and in some cases regulators) to finance investment in broadband networks, particularly where government or other form of state intervention is required, whether in developed or in developing markets. In implementing national broadband PPP projects that include open-access initiatives, a number of considerations need to be taken into account by governments and regulators as described in Table 3.6.

Table 3.6: Requirements for governments to foster and secure investment

☑	Consider local market conditions such as the level of Internet maturity, operator ownership structures and the regulatory and market structure
☑	Have realistic and well-defined broadband objectives with speed and coverage targets
☑	Introduce non-discriminatory, wholesale open access to broadband infrastructure
☑	Implement transparent procurement processes

Each of these elements is described in more detail in the following sections.

3.6.1 Consideration of local market conditions

There is general acceptance among managing authorities of the investment approaches and funding sources described above. As a result, managing authorities are increasingly becoming more focused on how their broadband vision (as defined in their national broadband plans) will be implemented and adapted to local conditions. National broadband plans set out a vision for broadband connectivity and development of ICT, detailing broadband coverage and speed and a set of actions to help achieve their broadband vision. Local conditions and factors that are likely to affect these considerations will include:

- **The development of the digital economy and Internet maturity**: Internet maturity includes factors such as Internet take-up; availability of local and compelling content; and development of e-government initiatives to connect schools, government offices and hospitals. It also includes implementing and enforcing cybersecurity regulations and improving ICT literacy. Economies that can demonstrate greater Internet maturity – or those that show they have plans in place to develop the Internet ecosystem – will drive Internet traffic growth. This in turn will encourage competitive investment in broadband infrastructure.
- **Political landscape and ownership structures**: managing authorities that retain whole or part ownership of incumbent operators (often regardless of their success as operators) are likely to be favoured by politicians to receive funding even if they are not necessarily the best equipped commercial operator. This may dissuade investment in broadband infrastructure from the private sector.
- **Market structure and regulatory effectiveness**: a market where a dominant operator is not required to provide wholesale non-discriminatory open access to its network can hold back broadband development in areas where broadband is most needed and can result in the unnecessary duplication of broadband infrastructure.

Governments and regulators should consider these aspects in the implementation and design of their national broadband plans.

3.6.2 Development of broadband targets

Another factor that influences the implementation of broadband projects relates to how governments and regulators develop their broadband targets and their understanding of the costs and funding requirements

to support that investment. Many managing authorities, particularly in developing markets, have developed broadband targets that are simply too aggressive, given current levels of investment in broadband infrastructure and the relatively low levels of Internet maturity in those economies.

Well-defined and realistic broadband targets will enable a better understanding of the range of technologies required to meet the targets, allowing a more accurate prediction of deployment costs. Knowing the costs will in turn allow managing authorities to establish the required funding contribution and allow operators to define their investment requirements. In some cases this can be an iterative process where the targets are revised until an optimum balance is achieved between optimistic speed and coverage targets, and the availability of funding.

Covernments and regulators could therefore adopt the following principles in defining their broadband targets:

- Targets are to be progressively defined, so that they increase in line with current market trends for the next ten years. The targets should define the broadband speed and coverage (by number of business and residential premises) over that time period.
- Targets need to distinguish between rural and urban areas. It is more likely that urban areas will require higher-speed services than rural areas, but greater funding will be required in rural areas.
- Targets need to be realistic and achievable rather than being over-optimistic and over-ambitious, otherwise it will not be possible to estimate whether the broadband project has been a success.

Coverage targets can be included in mobile spectrum licences or in fixed network licenses therefore investors would need to undertake a detailed assessment of the targets in order to assess the cost of acheiving them. They would also need to assess whether they are achievable at all so as not to commit to a project that cannot be delivered successfully.

3.6.3 Open-access networks

Open-access networks are another vital aspect of implementing broadband projects, particularly in the promotion of competiveness and fairness and, ultimately, to reduce duplication in infrastructure. The provision of open-access networks can ensure that operators have effective, non-discriminatory and transparent access to wholesale networks.

There are two dimensions to the definition of ‘open access’, i.e. an operational and a technical level. At the operational level, access must be:

- **effective**: it should provide the services requested without undue burdens such as onerous processes or overheads
- **transparent**: it should be clear how to use the service, and it must be provided efficiently
- **non-discriminatory**: it should be possible to demonstrate through some level of separation that services are provided in a non-discriminatory way, with some mechanism of recourse if non-price discrimination is suspected.

At the technical level, open-access services can be provided at

- layer 0: civil infrastructure (ducts, poles, towers)
- layer 1: transmission media (fibres, copper)
- layer 2: transmission point-to-point connections
- layer 3: Internet Protocol.

Open access at one level typically allows competition at higher levels. The principle of open-access networks can be applied to a number of the investment models considered in Section 2. Managing authorities will need to decide in which layers duplication should be avoided, and where competition – and duplication – can be encouraged. This will need to be done in advance based on analysis and modelling.

In terms of wireless networks, there is insufficient international experience to suggest what may constitute best practice in wholesale open-access wireless networks. Emerging projects may yet develop best practice, but such networks face significant organizational and strategic challenges.

3.6.4 Procurement

Due to the nature of public PPP projects involving public money funding, PPP projects are normally conducted as public network procurement. Public network procurements (whether financed through a universal service fund state or through other means) should be undertaken according to best-practice principles, ensuring they are fair, equitable, transparent, competitive and cost-effective. It is suggested that as many of these principles as possible are adhered to in the design of any public network procurement involving public subsidy. Broadband projects that are private in nature and do not involve any public funding are not bound by these principles, although many of the principles will still be applicable to private-led procurements. These principles are described in more detail in Annex 1.

4 Alternative approaches to funding broadband networks

The previous sections in this report have looked at strategies used by governments and operators to invest in broadband projects that require public subsidy, often in the form of PPP projects. The methods used by privately owned operators to raise funds from existing cashflows or financial markets to fund network investments is relatively well known and is therefore not discussed in this report. However, a growing number of investors – comprising of existing operators, new entrants and financiers – have developed alternative approaches to fund broadband network investments. To further examine alternative approaches to investment in broadband we have selected examples from four investor categories, as set out in Table 4.1.

Table 4.1: Overview of investor categories and corresponding case studies

Investor category	Case study	Existing parties
Existing market players	MGTS, Russia	MGTS
New market entrants	Google Fiber, USA Google Fiber, Uganda	Google Fiber Google Fiber
New financiers	SIGFOX, France Seacom, Africa Asia–Pacific Gateway, Asia	Elliot Management Convergence Partners Facebook
Not-for-profit investors	Community broadband, Germany	Communities
Source: Analysys Mason, 2015		

Moreover, we have provided a detailed description of a project case study for of each of these investor categories below. In each instance the motivation for the financing approach used is given, the role of the regulator to attract investment is discussed and an overview of potential barriers to investment is provided.

4.1 Existing market players

Operators have traditionally invested in broadband infrastructure in commercially viable areas using their own funds that have been allocated for capital investment. In some cases operators have generated funds through selling decommissioned network assets (e.g. copper networks) and using the proceeds to fund their broadband investments. Revenue can also be raised from selling old active equipment.[73]

Bezeq, a fixed and mobile operator in Israel, generated cumulative profits of ILS214 million (USD60.8 million)[74] between 2009 and 2013 by decommissioning its copper network. Another operator

exploring this approach is MGTS, a fixed-line operator in Russia. MGTS is discussed in more detail in the case study below.

4.1.1 Case study: MGTS, Russia

This case study was chosen to illustrate how MGTS, the fixed-line incumbent in the Moscow region, is funding its fibre network roll-out by decommissioning its legacy network.

MGTS is aggressively rolling out gigabit optical passive network (GPON) FTTH. MGTS had a PSTN capacity of 4.994 million lines at the end of 2012 and had passed 2.6 million homes with FTTH at the end of 2013. The ultimate objective for MGTS is to pass 4.4 million homes with FTTH by 2015.[75]

In 2013, the operator agreed to sell its 49 per cent stake of CJSC Business Nedvizhimost, the owner of telephone exchanges in Moscow, to Russian investment company Sistema. MGTS retains a portfolio of buildings in Moscow with a total footage of around 1 million square metres, although the properties already sold are considered to be the most valuable. MGTS notes that the sites will be freed up by the end of 2015 as a result of the GPON deployment.

The value of the transactions was RUB6.3 billion (USD194 million) and the funds will be reinvested to help fund the GPON roll-out. MGTS notes a total cost of around USD2 billion for its FTTH roll-out, of which around 80 per cent comes from homes passed costs – 50 per cent from construction costs and 30 per cent central office-related costs – the remaining 20 per cent comes from connection costs. This equates to USD360 per home passed – the transaction will in effect cover the costs of passing around 12.7 per cent of the total 4.4 million homes that will be covered.[76]

MGTS notes that it could generate more revenue from exchange sales and expects to divest further assets. The first tranche of exchange sales has been relatively more profitable for MGTS compared to other operators such as Bezeq. This reflects sales of high-value property in the Moscow region, Russia's richest area.

The operator also intends to generate revenue from selling copper and is working on the procedures to remove the copper lines. The project to remove and sell the copper will begin in earnest in 2016. MGTS is not yet issuing guidance on how much revenue it expects to generate from copper sales.

MGTS is making good progress in transferring customers to its GPON network. At the end of 2012, 20 per cent of homes passed with FTTH were subscribing to a GPON voice service, a figure that increased to 30.4 per cent at the end of 2013. This transition has allowed the company to improve the average revenue per user (ARPU): at the end of 2013, customers migrating to GPON offers had a 55 per cent higher ARPU than previously.[77]

Key lessons: MGTS

- MGTS commited to a GPON FTTH deployment strategy funded through divestment of key telecoms assets to help fund fibre roll-out and improve the company's competitive position for the medium to long term
- Consequently, MGTS has demonstrated that investment in fibre can generate higher ARPUs. These ARPUs can be generated through offering higher-layer services such as IPTV and video on demand, for example
- However, decommissioning the copper network can also result in losing voice-only customers, who do not want to migrate to the new network. MGTS acknowledges that during the migration process it will lose voice-only customers who do not wish to migrate. However, the company believes that its gains in the fixed broadband market will outweigh these losses
- The regulator allowed MGTS to decommission its copper network and divest the assets. The implementation of this approach is very dependent on whether there are local loop unbundling (LLU) or bitstream services. There is no LLU in Russia. The process of decommissioning the network will be much faster and easier to achieve in countries where the local loop infrastructure is not being shared with other operators

4.2 New market entrants

New market entrants are driven by a desire to address market gaps to serve their immediate or wider interests. For example, ISPs will focus on addressing the generation of connectivity-based revenues, while organizations operating higher up in the Internet value chain – traditionally not ISPs – can benefit from a strong Internet ecosystem that will allow their Internet services to be more widely used. The primary driver for the latter is to act as market catalyst to develop a mature Internet ecosystem, creating a demand for their services downstream.

The approach taken by the new entrants can vary based on the market context. In established economies, the issue is likely to be related to broadband providers' lack of motivation to invest in their legacy networks. In this scenario, the new entrants may be required to go head-to-head with the established players and develop more competitive propositions than the latter group. The desired outcome is that the new market competition will push established players to improve their service. In developing markets, the issue is likely to be the lack of infrastructure, as established providers may not have the funding to roll out and maintain the network. In this case, the new entrant may take the role of partnering with the existing providers, or even the government, to share the infrastructure cost. In the case of Google Fiber, Uganda (see below), our understanding is that the company funded the entire project.

4.2.1 Case study: Google Fiber, USA

Governments or regulators interested in attracting investment from new entrants need to create the right environment for this to occur. This example was selected because it describes how Google, a global player whose traditional core business is to provide services over the Internet, made the decision to invest in broadband network infrastructure and offer broadband services to ISPs and end users.

Google Fiber's initiative is driven by Google's ambition to "help make Internet access better and faster for everyone", as stated in 2010 when the company was still testing how to roll out its fibre network. Google is exploiting the opportunity to cherry pick a handful of cities where operators do not offer high-speed broadband services to offer end users high-speed connectivity. Its motivation for investing in fibre networks is to provide more opportunities for Google to offer advertising and content, generating revenues in addition to broadband subscriptions.

In December 2012, Google Fiber started offering fixed broadband and TV services over its fibre to the premises (FTTP) network, in Kansas City. The city was chosen for its good economic infrastructure and a business-friendly environment; for example, utility conduits avoided the need for digging up streets.[78] Currently three cities are covered by Google Fiber and there are expansion plans for five more across the USA.

There are estimates from analysts of close to USD84 million spent to pass 149 000 households in Kansas City, resulting in a cost per household of USD564. The cost to acquire and connect a broadband customer is estimated to be USD464.[79]

A key differentiator of Google Fiber's proposition is its high-speed broadband, offering up to 1 000Mbit/s. The reaction from other broadband providers has already been felt. In August 2014, Comcast and Time Warner announced that they would be increasing their Internet access speed to customers in Kansas City.[80] And in February 2015, AT&T announced that it would match Google Fiber's price and speed in Kansas City.[81]

In its 'Google Fiber City checklist',[82] Google lists the requirements that applicant cities need to meet to be considered as a candidate for future network expansion. An attractive environment for Google Fiber to expand would offer:

- transparency about existing infrastructure
- clear rules about gaining access to the existing infrastructure
- facilitation of permitting, construction licenses.

Key lessons: Google Fiber (USA)

- Having easy access to economic infrastructure and utility ducts was a key reason behind Google selecting Kansas City, as it reduced the need for street digs which in turn reduced investment costs and the time taken to offer services to the market. Governments and regulators should consider how they can increase the attractiveness of the investment environment to make the business case for new entrant investment commercially viable. This can be achieved through undertaking operators and investor consultations to understand their concerns which may be holding back investment
- Government capital investment needs may be reduced by creating the correct investment conditions for private-sector investment and by working closely with operators. The favourable investment environment in Kansas City which attracted Google benefited the local government as it was not required to make an investment which it would otherwise have been unable to source. According to the Mayor of Kansas City they would not have been able pass a bond issue for the investment required
- The Federal Communications Commission (FCC) played no role in the network roll-out of Google Fiber in Kansas City as the main facilitator was the local government, which expedited the permit process, giving rights of way for little or no cost and allowing Google Fiber to build in desired areas
- Heavy regulation can create a barrier to new entrants. As part of the lessons Google Fiber took from deploying in Kansas City, it said that investment flows into areas that are less affected by regulation than areas that are dominated by it. However, clearly the amount of regulation required is dependent upon the market effectiveness in each country allowing Google Fiber to build in desired areas

4.2.2 Case study: Google Fiber, Uganda

The example of Google Fiber investing in Uganda was chosen to demonstrate that the approach taken by Google in the USA can also be replicated in developing markets. In this case, Google Fiber is not competing with broadband service providers; instead it is selling them network wholesale services.

The lack of adequate infrastructure in Uganda has been a barrier to making high-speed broadband available and to drive Internet maturity. For Google, this situation hinders its ability to grow revenue from online advertising, its core business.

According to the ICT Association of Uganda, there are only a limited number of local players with the knowledge and resources to invest in broadband infrastructure. In addition, those organizations with the capabilities to invest may have been deterred from investing due to the fear of assisting their competitors.

In November 2013, Google Fiber announced that it had deployed a fibre backbone network in Kampala, Uganda. This network enables local mobile operators and ISPs to increase their data speed, with a speed of up to 100 times faster than usual in some parts of Kampala.

Although the investment taken by Google in Uganda is different to that in Kansas City, its motovations are the same. The main motivation is to stimulate broadband take-up and usage among end users, providing Google with more opportunities to sell advertising and generate revenue from content in the future.

The amount invested by Google Fiber has not been disclosed. However, as an indication, in 2006 the Ugandan government tried to implement a similar broadband infrastructure project which was worth USD100 million; this provides a useful proxy for the level of investment required.

Google Fiber emphasizes the importance of local governments in creating the right environment to attract new entrants. According to Google, "[l]ocal government can actually play a large role in reducing the complexity of fibre networks just by giving new entrants access to maps of infrastructure, including maps of gas and water mains and things like expedited construction permits".[83] Making infrastructure available to new entrants is key to promoting network coverage expansion.

Key lessons: Google Fiber (Uganda)

- Local operators may be deterred from investing in broadband infrastructure through the fear of assisting their competitors, e.g. if required to offer parts of their network on a wholesale open-access basis. This concern can be reduced if governments or regulators offer incentives such as a limited period of exclusivity allowing the operator to recuperate their intial investment before offering the network for wholesale access
- Local governments in developing markets have a central role in attracting new providers. As in the previous case study, it is very important for new entrants to be clear about which infrastructure (e.g. ducts, poles) is available to them and where it is located
- Google Fiber succeeded in installing the network in Kampala whereas the Ugandan government failed to do so in 2006 while partnering with a network equipment vendor. Therefore a service provider that is incentivized by end-user revenues can be more successful than using a third party merely to deploy the network.

4.3 New financiers

Investment in broadband infrastructure may also be sourced from more unlikely institutions such as hedge funds or corporate organizations which do not traditionally invest in broadband infrastructure. These organizations are normally driven by the opportunity to recoup their investment through public listing or

when the company is sold or through downstream revenues, i.e. the enablement of the broadband infrastructure allows broadband dependent products and services to be sold.

The investments that can deliver the high levels of return sought by hedge funds normally carry a reasonable level of risk. This risk could be due to the sheer scale of the project or the uncertainty around the deployment of a new technology. As a result, these investments tend to involve multiple investors to spread the investment risk.

As an example, Gigaclear, a new UK-based fibre broadband network operator, has been able to fund its business expansion with the support of equity funds. Gigaclear is focused on rolling out fibre networks across rural areas in England. In February 2015, the company secured GBP6.5 million from investors such as CF Woodford Equity Income Fund and Forward Private Equity[84].

Providers of Internet services such as Google and Facebook have also been involved in large-scale investments in broadband infrastructure. Both companies' business growth depends on people having adequate Internet access. The yearly USD multi-billion revenue generated by these type of organizations allows them to bear the risk of participating in large-scale investments.

4.3.1 Case study: SIGFOX, France

This case study was chosen as it demonstrates how a hedge fund has invested in a start-up to support the development and expansion of a global cellular technology developer, as opposed to investing in broadband infrastructure. This also demonstrates the interest in investing in emerging technologies.

Elliot Management is a hedge fund founded in 1977 and is based in the USA. The company invests in debt and equity securities and its investment focus tends to be on companies undergoing restructuring. In 2015, Elliot Management participated in SIGFOX's Series D funding round.[85]

SIGFOX is a French start-up that developed a cellular connectivity technology for the Internet of Things. It has developed a very low-power, long-range, low message-size RF protocol that runs in the sub-GHz spectrum band to enable a number of smart intiatives, but the technology is new and the applications are still evolving.

Elliot Management has demonstrated its intention to support the expansion of the SIGFOX network in the USA. This support is driven by the belief that the company can provide a high return on investment in future years. The Series D investment round raised USD115 million[86] from a number of investors, including Elliot Management, which was the only financial institution involved. Other investors included leading mobile operators (Telefonica, SK Telecom and NTT DOCOMO) and industrial partners (GDF SUEZ, Air Liquide and Eutelsat).

The investors collectively stand to benefit from the development of 'smart' intiatives such as energy management, energy efficiency, sustainable cities, Internet of Things and machine to machine.

The funding will be used to accelerate SIGFOX's worldwide network roll-out programme in Europe, Asia and the Americas in association with international telecoms operators.

SIGFOX-based devices have been deployed in a number of instances. SIGFOX has signed a contract with TDF, continental Europe's biggest owner of broadcast and telecoms masts, to expand its national coverage. In 2014, SIGFOX partned with broadcast tower provider Arqiva, to build a UK network dedicated to the Internet of Things. In 2015 it announced that it was collaborating with Texas Instruments to integrate their technology into its chipsets.

Key lessons: SIGFOX

- Investing in more unfamiliar areas can raise the risk for investors but can offer an upside with high potential. Investing in new technologies is not Elliot Management's typical type of investment, but if SIGFOX succeeds as the prevailing technology to enable the Internet of Things market, the return on investment can be significant
- Other fixed and wireless operators could consider investment from hedge funds, particularly for the expansion of fixed broadband networks. However, the lack of notable examples suggests that some hedge funds may be hesitant to to invest in long-term infrastructure projects
- It is interesting to note that the Series D funding was not made in isolation by a hedge fund alone, but in collaboration with a number of high-profile global partners which stand to benefit from the success of the technology as it evolves. These investors would provide financial investors with a higher degree of certainty and reduce the risk of the investment. This approach should be considered by technology companies looking for alternative sources of investment
- Telecoms regulators or governments had no direct involvement in the investment in SIGFOX. However, regulators do still have overall responsibility for ensuring that the market environment is competitive and attractive for investment. In this instance, regulators will also have responsibility for making spectrum available for low-power wireless networks

4.3.2 Case study: Seacom, Africa

This case study was chosen as it demonstates that financial institutions (particularly those that focus on and understand the technology sector) also invest in broadband infrastructure projects.

Convergence Partners is an investment management company focused on the telcoms sector in Africa. The company is based in South Africa and its investments are typically targeted at ICT infrastructure development.

Seacom was established in 2007 and in 2009 launched the first submarine cable system along East Africa linking South Africa, Tanzania, Uganda, Kenya and Mozambique, with major Internet connection hubs in Europe and Asia. Seacom's aim was to bring affordable and high-quality broadband to Southern and Eastern Africa as an alternative to expensive satellite technology, which was limited in service capability. The case for investment was supported by the potential long-term economic growth benefits which resulted in an 'open-access' undersea cable system supporting high bandwidth connectivity.

Seacom provides open-access PoPs and global partnerships to provide end-to-end wholesale connectivity for African operators, but it is not regulated. Broadband was previously limited, expensive and low in quality. The consequent broad take-up of broadband across East Africa has largely been attributed to Seacom.

Seacom is 100 per cent privately funded. Convergence Partners was one of the investors in Seacom. The project cost USD650 million, of which Convergence Partners contributed USD37.5 million[87]. This investment gave the company an equity share of 12.5 per cent of the asset. Other investors in Seacom included Nedbank (offering long-term commercial loans), and various African economic development funds.

Convergence Partners made the investment in Seacom because it expected significant growth in data traffic following growth of mobile take-up in Africa. A major part of its strategy is to focus on projects that improve access to communications, broadband services and technology offerings throughout Africa.

In July 2009, the Seacom cable went live. According to Remgro, a listed investment fund with a 25 per cent share of Seacom, the cable infrastructure company had losses at least since 2011 and until 2013. In 2014,

Seacom's headline earnings were ZAR40 million (USD3.34 million[88]), compared to a loss of ZAR32 million (USD2.67 million[88]) in the previous year[89].

The financial performance of Seacom is an indicator of the high level of risk that large infrastructure projects involve. Over time it is likely that terrestrial connectivity prices will decrease, and the demand for Seacom's service is likely to increase; however, its future earnings potential remain uncertain.

Key lessons: Seacom, Africa

- The role for regulators in this case is limited. There would need to be a case for regulatory intervention which is currently unclear, particularly as the cable has brought about significant economic benefits and is available on an open-access basis. In addition, coordinating regulatory efforts across a range of countries can be complex to implement. Regulators would need to undertake a comprehensive regulatory analysis and consider whether there is a case for intervention
- Funding was not made in isolation but in collaboration with a number of high-profile global investors, which reduced the risk of the investment. However, in this instance there was no investment made by operators that stood to benefit from the infrastructure directly. This may be a contributing factor to it being loss-making
- Investors should be fully aware of the demand characteristics behind their investments. Investment in large infrastructure projects carries high risk due to the high investment required. For example, the infrastructure may be made available too soon and there may not be enough demand to make the project commercially feasible in the short term. A reason for Seacom's poor financial performance is that the demand for data is not high enough
- High prices for terrestrial broadband, lack of broadband penetration and low usage of high bandwidth services and applications are some reasons why the demand for data is not high enough. Regulators and governments can take actions to improve broadband take-up and the availability of broadband services to improve the market attractiveness for investors

4.3.3 Case study: Facebook Asia–Pacific Gateway, Asia

This case study was chosen because it demonstrates an example of an established corporate organization investing in relatively new area – outwith its traditional business model – in the expectation of generating downstream revenues.

The Asia–Pacific Gateway (APG) is a 10 000km undersea cable project designed to improve Internet speeds for citizens and businesses in Asia. The cable will run directly from Malaysia to South Korea and Japan, with links branching off to other countries. The fibre-optic cable will help users in these countries to send and receive data faster and lower the dependency upon Singapore as the main gateway for Internet traffic. This cable is also expected to minimize the the number of hops made by Internet traffic, improving latency and user experience.

It will also provide countries in the region with an alternative to existing cables that have suffered from several cable breaks. In April 2015, Internet users from Vietnam faced connectivity issues from problems with the Asia-America Gateway cable. These issues were expected to last three weeks.[90]

The existing broadband infrastructure in some countries in South Asia was limiting the user experience of Facebook users. Despite the region being seen as one of the fastest-growing markets for Facebook, the company wanted to provide further support to that growth. Facebook is known worldwide as a provider of online social media services. Its core revenue is driven by online advertising. Facebook's motivation is therefore similar to that of Google and other software companies in that it wants to boost its membership

in growing markets so that its business can grow. Facebook has noted that the APG will improve the Facebook experience for users in India, Indonesia, Malaysia, the Philippines, Hong Kong and Singapore.[91]

In 2012, Facebook joined a consortium of investors supporting the roll-out of the APG. The participation of Facebook in 2012 was a very important factor in helping to launch the project, as the consortium had been struggling with lack of funding since 2009. The project to construct and maintain the APG is funded by a group that includes significant operators such as China Mobile, China Telecom, China Unicom, Chunghwa Telecom, KT Corp, LG Uplus, NTT Communications, StarHub, Time dotCom (Global Transit), Viettel, Vietnam Posts and Telecommunications Group (VNPT). The total investment from the 12 members of the consortium was USD450 million. It has not been disclosed how much Facebook invested.

The APG cable is expected to be completed in 2016.[92] The intervention of regulators is unlikely, but is is expected that consortium members will have equal access to broadband capacity.

Key lessons: Facebook/Asia–Pacific Gateway (APG)

- Facebook's investment was seen as the enabler from a financing perspective. Notably, a number of high-profile global operators (and co-investors) will be users of the undersea cable and as a result are likely to direct international traffic onto it, contributing to its growth
- The APG will use an open-access model to ensure all end users are able to utilize the asset without discrimination. This will be difficult to regulate due to the multiple jurisdictions that the cable runs through; instead, it will be self-regulated and the success of the self-regulation will depend upon cooperation between the operators
- Although governments and regulators in Asian countries did not play a prominent role in the formation of the APG, they will still play an essential role 'in-country' to extend broadband penetration and to drive user demand

4.4 Not-for-profit investors

In this context, not-for-profit investors refer to a socially responsible entity (e.g. cooperative) that invests in the construction and operation of broadband networks that are – for the most part - separate from the networks of commercial service providers.

The key difference between a commercial operator and a not-for-profit investor is that commercial operators are more likely to require greater returns on their investment; by contrast a not-for-profit investor is more likely to invest its profits (clearly depending on the agreement of the legal entity) back into the construction and operation of broadband networks. For this reason, not-for-profit broadband investments can be more commercially feasible in areas where the returns are too low for commercial operators.

Community broadband networks, for example, tend to be driven by communities as 'self-build' networks located in remote geographical areas, where there is typically a lower commercial incentive for operators to roll out their networks. Project funding can be mortgaged to make it more affordable. An alternative is to use crowdfunding – which is discussed in more detail in Section 6 – to raise funds to finance the network build. This type of approach is expected to be more common in regions where people have a relatively high disposable income. According to a report published by the Plunkett Foundation[93], the cost of rolling out fibre per property can be GBP2 000 (USD3 138) using overhead cables and higher if it requires digging trenches.

Self-build community broadband networks are normally based on FTTH technology. Communities can build these networks at much lower costs than commercial operators, as they do not charge commercial rates for undertaking the work or may offer to do it free of charge. By the very nature of communities, self-build networks can be small in scale, and may need to overcome a number of challenges: i) they are often run by volunteers, which may not be a sustainable situation in the long term; ii) they may not be vertically

integrated and therefore cannot offer consumers the choice of services that larger commercial operators may be able to offer.

Some governments have supported these initiatives. The Scottish Government, for example, through its Community Broadband Scotland (CBS) scheme, provides financial support to communities that decide to engage in community broadband projects[94]. Eligible communities can receive grants across the different stages of the project:

- initial scoping and feasibility assessment grant from GBP2 000 to GBP5 000 (USD3 138 to USD7 845)
- detailed project planning grant from GBP7 500 to GBP15 000 (USD11 767 to USD23 538)
- capital investment in the broadband project, up to a maximum of 89 per cent of capital infrastructure costs.

So far the CBS has invested in over nine projects in rural Scottish communities.

4.4.1 Case study: Community broadband, Germany

This case study has been chosen because it shows how communities in rural Germany successfully joined efforts to finance the construction of a high-speed broadband network. The investors included a mix of local governments, businesses and individuals.

These communities are located in the German provinces of Nordrhein-Westfalen and Schleswig-Holstein and previously did not have access to adequate broadband services. These communities are in less populated areas that lack the commercial incentive to attract the investment from private service providers. In addition, the government only provided funding for broadband connections with speeds up to 2Mbit/s.

Through crowdfunding, these communities invested in broadband infrastructure. This infrastructure is then rented to service providers, financing the investment cost.[95] A minimum investment of EUR10 000 (USD11 392) could offer investors an annual interest rate between 3 and 5 per cent.[96] For the investment to go ahead, a minimum of 70 per cent of households in that community must sign up for a connection.

The approach is seen to have been a success. The largest example is from the province of Schleswig-Holstein. This initiative represents an investment of EUR70 million. It started in 2010 and involves 50 communities, of which 11 have completed their infrastructure deployment.[97]

Key lessons: Community broadband

- Community broadband networks can be successful in deploying fibre networks in areas which are commercially unviable for operators. However, they are relatively new and still in the early phases of deployment, therefore it is not clear how commercially sustainable they can be in the long term
- Community broadband networks will often require external financing to get them started. Investments can be made by private crowdfunded investments, by government grants or a mix of the two. Governments offering grants should vet every stage of the grant award process to ensure the project is fully compliant with its investment criteria
- Regulators may wish to ensure that communities in receipt of government grants offer the infrastructure on an open-access basis. However, this may reduce the returns to the community broadband network and so the community should consider the impact of this in its early business-planning stages
- Communities should consider how the services portfolio might evolve over time as consumers become increasingly demanding of over-the-top and streaming services. These services will require high reliability networks. In addition, communities might find it difficult to negotiate competitive content deals that commercial operators are able to offer
- Innovative business approaches can make it feasible for communities to invest in broadband infrastructure. In this case study, the investors retain ownership of the infrastructure and are entitled to an interest rate. This return could be used to offset a possible borrowing used to invest in the project

4.5 Investments in disruptive technologies

The term 'disruptive technologies' referes to technical innovations that are being developed – and not yet in full deployment – which may offer the potential to provide an alternative to current technical solutions for the provision of broadband services.

Investing in disruptive technologies can be high risk, as it may be difficult for new technologies to challenge well-established ones which have been trialled and tested. Disruptive technologies may also face implementation barriers from regulatory concerns or market players that feel their business model is threatened. Therefore the financial backers of disruptive technologies tend to be non-traditional operators looking for alternative low-cost means to address specific connectivity issues (e.g. in remote areas) which may satisfy their wider business objectives.

One such technology that is gaining prominence in developing and developed markets is the transmission of data using UHF white space. The term 'TV white spaces' usually refers to unoccupied portions of spectrum in the VHF/UHF terrestrial television frequency bands in some geographical areas.

This approach can address issues such as the lack of available spectrum, because it is licence exempt[98]. It also benefits from the strong propagation characteristics allowed by the UHF spectrum, meaning less base stations are required to cover a given area.

The interest in white-space technology is not confined to any particular region. Pilot projects have been launched across the world for different types of applications, such as connecting remote health units in Bhutan and providing Internet access on a ferry boat in Scotland [99]. Some countries have staged trials of TV white-spaces operations. Other countries – such as the US and UK – are developing TV white-space regulations[100].

5 Financial innovations in funding services and applications

So far this study has looked at funding strategies used by investors and governments to finance broadband networks. However, the digital ecosystem has evolved so that there is a very tight and direct relationship between the development of broadband infrastructure and the evolution of higher-layer services and applications. For example, the demand for broadband infrastructure is being driven by an increase in take-up and usage of higher-layer services and applications; and without broadband it would not be possible to run the higher-layer services and applications. Given this tight relationship and in the context of investment strategies this section reviews what financial innovations are being used to fund investments in services and applications which are dependent upon broadband connectivity. The financial innovations considered are alternatives to other more common financing sources such as bank loans, angel investment, venture capital or private equity – which are well-known means of financing and therefore not discussed in this report – and include innovations in the following categories which appear to be gaining in popularity. Links to relevant case studies are also provided:

Table 5.1: Types of financial innovations and related case studies

Financial innovation	Case study	Executing parties
Crowdfunding	Star Citizen, USA Pebble, USA Shyp, USA	Individuals Individuals Private investors
Pension funding	Hipcom, UK	Business owner
Bitcoin currency	mexBT, Mexico	Seedcoin
Charity or non-profit institutions	Aentropico, Colombia	INNPulsa and Fundación Bavaria
Source: Analysys Mason, 2015		

In the section below a description is provided of the funding approach used and then examples of companies that have benefited from that type of investment are presented. Note that regulators have played a minimal role in the deployment of higher-layer services and therefore the role of regulators is not included in this section.

5.1 Crowdfunding

Crowdfunding is a significant and recent financial innovation that has brought down investment barriers, making investment more accessible to entrepreneurs. As the name suggests, crowdfunding raises investment from a large number of people over the Internet on a crowdfunding website such as Kickstarter, RocketHub or AngelList. It is also often referred to as peer-to-peer lending.

Individual investments can be as small as USD15[101], making it affordable enough for many people to invest. Given the large numbers of people that can invest in a crowdfunded project, the risk to individuals is reduced, making it an attractive investment vehicle for semi-professional or first-time investors. Entrepreneurs are required to submit their projects to a crowdfunding website, define the investment target, the deadline for funding and the reward to investors.

The amounts raised by project can vary from USD thousands to USD millions. This funding approach is typically used by start-up companies from varied sectors (e.g. real estate, consumer products, technology). However, crowdfunding can also be used to support investment in broadband infrastructure. Crowdfiber is a crowdfunding platform designed to raise funds to invest in high-speed broadband in communities across the USA. This tool allows communities to advertise their campaigns and collect funding[102]. A more advanced version of the tool is available to service providers[103].

According to an industry survey report from Massolution[104], crowdfunding globally is expected to reach USD34.4 billion in 2015, growing from USD16.2 billion in 2014. Of the amount raised in 2014, 59 per cent was in North America, 21 per cent in Asia and 20 per cent in Europe.

The risk of crowdfunding will vary by the type of crowdfunding used, the company or project receiving the funds and the amount invested. Three types of crowdfunding are considered: donation, equity and debt.

- Donation crowdfunding carries the risk of committing funds to a project that may not materialize.
- Equity crowdfunding investments can face the risk of lack of liquidity, equity dilution or loss of investment if the company defaults.
- Debt crowdfunding is subject to risks such as loss of investment and interest payments.

Financial regulation plays a very important role in making crowdfunding accessible to people. In the USA, the Securities and Exchange Commission (SEC) announced in March 2015 that it will be possible for non-accredited[105] investors to invest using equity crowdfunding.

Investors in donation crowdfunding tend to be driven by personal motivation. They are likely to have a connection to the company, brand or project being financed. In some cases, the reward of donating is the personal gratification of contributing. In other cases, the investor may have access to privileges such as a discount or free access to a service or product.

In equity crowdfunding, investors receive an equity stake in return for the investment made in a company. Entrepreneurs define the amount of equity stake for the target funding. Investors' corresponding equity share will depend on how much they invest in the project. The crowdfunding platform may also offer recommendations to investors on the opportunities considered most attractive. This service can assist investors in their decision as these opportunities have already gone through a filtering process.

In debt crowdfunding, the investor will lend funds to a company and expect this amount to be returned plus interest by fixed dates. Mini bonds is a type of debt crowdfunding approach that has been recently made available to potential investors. Typically, debt funding is used more by companies that are already well established and are generating a profit. There are still only a few examples available of companies that used this investment approach. It is possible that as it matures, it will be used by companies developing Internet-based services and applications.

5.1.1 Case study: Star Citizen, USA

This case study shows how donation crowdfunding can successfully attract investment through crowdfunding platforms as well as through the company website.

Start Citizen is a video game created by Chris Roberts. It is a game that can be played online in a multiplayer mode. A good gaming experience requires the user to have a fast and low-latency broadband connection.

Chris initially failed to convince private investors to invest in the video game. He then turned to crowdfunding. His strategy was to raise around USD2 million from this source and hope that this would demonstrate to private investors that there is demand for the product, convincing them to contribute with the remainder to reach a minimum of USD14 million.[106]

The crowdfunding was done using Kickstarter's online platform and the company's own website. The benefit of using its own website to host the crowdfunding is that the company does not have to pay fees to crowdfunding platforms. If a project is successfully funded in the UK, Kickstarter will charge 5 per cent of total funds raised plus payment processing fees.

This approach proved to be so successful that Chris no longer needed to source funds from private investors. Since October 2012, the company raised over USD81 million[107]. This value is of May 2015 and is still growing as people keep pledging funds to the project. The vast majority of the funding was crowdfunded from the game's website. Only USD2 million were raised from Kickstarter between October and November 2012[108]. Overall, the game received funds from almost 900 000 people, each paying an average of USD90.

The investment risk is measured by the likelihood that the project will be completed once the target funding is achieved and by how much has been invested. For this project, the investment risk is measured by the following:

- the low minimum investment required (only USD90)
- the project founder's strong track record in developing video games.

In return for their investment, people can influence how the game is developed based on how much they invest. In addition, investors also have early and free access to the game[109], which should come available in 2015[110].

Financial services regulators do not typically regulate donation crowdfunding. This crowdfunding model corresponds to the provision of money for charitable reasons or for a non-monetary reward. As a result it is not seen by regulators as an investment and is exempt from regulation.

Key lessons: Star Citizen

- Donation crowdfunding is typically exempt from regulation by financial services regulators, and can therefore be relatively straightforward to set up and to attract investors. However, investors should be aware that the lack of financial regulation may introduce risks and that they should be prepared to undertake their own due diligence to asses the level of risk when considering an investment
- The Star Citizen project was funded using a combination of crowdfunding from a private platform (Kickstarter) and from the project's own website. Using the own website for crowdfunding means that the company does not have to pay fees to a private platform. This two-pronged approach can limit the fees that businesses need to pay to the crowdfunding platform. On the other hand, the project may lose visibility, particularly if the website is new
- Donation crowdfunding is more likely to be successful in developed markets where investors are also potential end users

5.1.2 Case study: Pebble, USA

Pebble is a company that develops technology for smart watches. It sells a range of smart watches, which allow users to access a range of apps that rely on the connectivity provided by a smartphone. For this proposition to be feasible, there needs to be a good quality data connectivity to the smartphone.

The company is relatively small and on its own lacks the funds required to invest in product development. During its most recent fundraising session (April 2015), Pebble raised over USD20 million from more than 78 000 backers on the crowdfunding platform Kickstarter.

For investors, the risk is measured by the likelihood that the project will be completed once the target funding is achieved and by how much is invested. The minimum required investment is USD159. In return for their investment, people will receive a Pebble watch at a price lower than the retail price. The higher the investment, the lower the price per watch. Backers of the project will also receive the watch before it is made available to the general public.

Pebble used Kickstarter as it believed this was the most easy and efficient way to get its latest product to the people who were likely to want it the most. The company achieved its fund-raising target within three months.

As mentioned in the previous case study, the intervention of the financial services regulator in this type of fund-raising approach is unlikely.

Key lessons: Pebble

- Pebble used crowdfunding to finance the product development of its smart watch. The funds raised met the company's target, allowing it to proceed with the development of the new version of the smart watch
- Using a crowdfunding platform allowed Pebble to target the people that are more interested in its products. These investors are likely to be 'early adopter' consumers that follow the industry closely and are keen to have possession of the latest 'must-have' gadget. Attracting early adopters is essential to any start-up company's business as they wil be the most honest critics providing essential product improvement feedback

5.1.3 Case study: Shyp, USA

This case study was chosen as the firm Shyp used equity crowdfunding which is gaining in popularity and is subject to financial regulation.

Shyp provides logistic services requested over a smartphone app. Customer using the app take photos of an item they wish to order and select the delivery address. A large part of Shyp's business is dependent upon the growth of the e-commerce industry, e.g. delivering packages for online shops and easing online returns for consumers.

As a start-up, Shyp did not have the funding required to launch its business. The entrepreneurs behind Shyp wanted their business to be featured on AngelList, a crowdfunding platform, so they could raise their visibility to potential investors. A featured business is recommended as an interesting investment by AngelList. These opportunities suggest a lower level of investment risk, making them more attractive for investors.

Shyp succeeded in being featured and raised USD2.1 million from two syndicated investors over the equity crowdfunding platform AngelList. It has not been disclosed which amount of equity corresponds to that investment. The investment risk for investors was high as Shyp was a start-up when it initially received funding support from investors via AngelList. The fund raised was at an early seed stage.

Shyp is available to download in iOS or Android but the service is only available to customers in San Francisco, New York City, Miami and Los Angeles. Shyp has been experiencing 20 per cent month-over-month growth, with online returns representing 15 per cent of its business.

Financial regulators have an important role to play to make equity crowdfunding an attractive alternative funding source. The requirements enforced upon crowdfunding platforms protect the consumer and the market's growth as a result. In February 2015, the Financial Conduct Authority, the UK's financial services regulator, introduced rules to regulate equity-based crowdfunding. These rules were designed to allow investors to assess the risk and to understand who will ultimately borrow the money. In the UK, the rules also applied core consumer protection requirements to firms operating in this market. For example, client money must be protected and firms must meet minimum capital standards. Finally, firms running these platforms must have resolution plans in place so that, in the event of the platform collapsing, loan repayments will continue to be collected and those lending money therefore do not lose out.

Key lessons: Shyp

- Shyp used equity crowdfunding to raise the funds to launch the company. Securing a 'featured' position in the crowdfunding platform enhanced Shyp's chances of succeeding on its fundraising
- The popularity of equity-based crowd-funding means that financial regulators and governments may need to start applying rules to protect consumers and to protect investors in the event the firm collapses, for example
- The ability of firms to attract funding is dependent upon the growth of the digital industries and e-commerce sectors. Governments therefore have a responsibility in promoting the use of e-services to drive take-up and demand

5.2 Pension funding

This financing approach allows entrepreneurs to use their own pension fund to secure a loan. The pension manager will act as the investor by granting a loan that can be secured by the pension fund of the entrepreneur or by the entrepreneur's business assets. Alternatively, the pension fund manager can also buy an asset from the business and lease it back.

The amount that can be raised by entrepreneurs would be dependent on their loan collateral and the fund manager's risk aversion. For the pension fund managers, this approach allows them to generate additional revenue from available resources. Pension funding is used by businesses at different stages of maturity. Some entrepreneurs use it to fund their start-up, others to fund business expansion.

People dissatisfied with their pension fund's performance and unwilling to give up ownership of their business to other parties may find this approach appealing. As a preliminary step, entrepreneurs need to transfer part or all their pension savings into a self-invested personal pension or small self-administered scheme. These pensions give their owners investment powers such as the ability to invest in their own businesses. Only then can the fund manager provide the financing service. Our research shows that this funding approach is currently available only in the UK, although it is possible that other countries could offer it in future.

The investment risk for this approach can be relatively low for the investor. The loan cannot exceed 50 per cent of the pension fund's net asset value and may also be secured against an asset of similar or higher value[111].

5.2.1 Case study: Hipcom, UK

This case study was chosen as it shows how the government can facilitate the use of financial resources that otherwise would be relatively static.

Hipcom is a Cloud communication company whose main business is buying telecoms licences from providers and upgrading them to sell on. This process is lengthy and for the business to grow it requires additional sums of capital to buy new licences.

Allan Murdoch, Hipcom's former owner, wanted to invest in the company without diluting his equity. He also wanted to retain control of the company. Allan decided to use his own pension fund to access the required capital to expand the business. The fund manager provided a loan to invest in Hipcom based on Allan's pension fund amount. In return, Hipcom pays an interest rate to the fund manager.

The level of risk for the lender is relatively low. The loan value must not exceed 50 per cent of the pension fund's net asset value and other company assets can additionally be used as collateral. Allan raised GBP684 000 over three stages (GPB329 000, GBP155 000 and GBP200 000). With this approach, he managed to strengthen Hipcom and retain the same equity in the business.

Key lessons: Hipcom

- Hypcom obtained loans to invest in its business by using the owner's pension fund as collateral, allowing the business to expand and be more competitive
- For pension fund managers, this funding approach can generate additional revenue from using existing funds as collateral for loans
- This type of investment approach is dependent on the government allowing pension funds to be used for such a purpose. By facilitating the use of resources that otherwise would be static, the government can create an incentive for people to increase their savings and help businesses to find alternative financing sources

5.3 Bitcoin currency

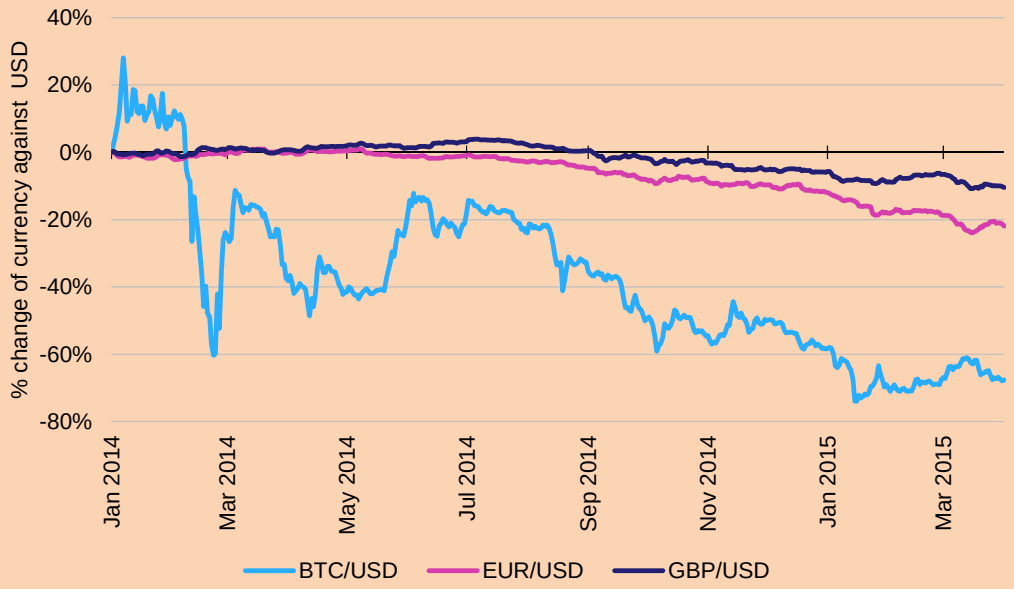
Bitcoin is a digital currency (represented by the currency symbol BTC) which can be used to finance companies. Seedcoin, a start-up incubator, has invested in businesses using bitcoin currency exclusively. The incubator is focused on supporting businesses that can help to develop the bitcoin currency. This financing approach is typically made available to start-ups.

Seedcoin also raises funds in bitcoin currency. This task can carry considerable risk due to the currency's volatility. Between January 2014 and April 2015, for example, bitcoin has lost over 60 per cent of its value against USD. Over the same period, the EUR lost 22 per cent and GBP 10 per cent (see Figure 5.2). This strong value volatility suggests digital currencies may have a higher level of risk compared to more stable primary currencies. Entrepreneurs receiving funding in digital currency need to consider its volatility risk. Another example of the high level of risk is the hacking theft of BTC750 000 (USD575 million) from the bitcoin exchange MtGox in 2014[112]. The uncertainty around digital currencies has led countries such as China and Russia to restrict how they can be used.

Based on previous funding rounds from Seedcoin, the size of the investments per company has ranged from BTC100 to BTC500. At the time of the latest funding round, April 2014, these values would have corresponded to around USD50 000 and USD250 000, respectively. The target markets of the start-ups vary by region and can include Africa (TagPesa) and Latin America (mexBT). TagPesa is an exchange and remittance company based in Kenya. The company aims to make it easy and convenient for people to make transactions and transfer money internationally[113]. One of the service's features is the ability for Kenyans to deposit and withdraw money from their M-Pesa account[114]. In 2015, TagPesa was acquired by igot, an Australia based Bitcoin exchange. The digital currencies trading platform mexBT will feature in the next case study.

The lack of regulation of digital currencies is a key factor in its associated risk. The uncertainty and distrust around digital currencies means that governments are reluctant to regulate it. The impact of regulation on the success of digital currencies was shown in January 2015, when Coinbase was announced as the first bitcoin exchange in the USA. The value of the currency immediately rose to reflect that news. This momentum was short-lived as the California State Government denied the veracity of the announcement shortly thereafter[115].

Figure 5.2: Percentage change of selected currencies against the USD from January 2014 to March 2015



Source: Oanda, 2015

5.3.1 Case study: meXBT, Mexico

This case study was chosen as it demonstrates how governments can promote the development of the digital currencies market by implementing adequate regulation.

meXBT is a digital currencies trading platform (i.e. for currencies like bitcoin and litecoin). One of its objectives is to cater for the remittances market, particularly between Mexico and the USA. The company is based in Mexico and provides services in Latin America.

One of the objectives of mexBT is helping the unbanked population to move money using their mobile phones. The company has partnered with cash payment processors to facilitate deposits and withdrawals. The company required funding to develop its trading platform. It applied to receive support as a start-up to Seedcoin, an incubator focused on bitcoin-based businesses. In 2014, the incubator invested BTC250 in mexBT.[116] At the time this amount corresponded to around USD150 000; currently it would be worth close to USD62 000.[117] The equity share received by Seedcoin is not disclosed but it typically varies between 10 and 20 per cent.[118]

meXBT claims that the support from Seedcoin was very important not only for funding but also from a mentoring perspective, due to the incubator's expert knowledge of the bitcoin market. In November 2014, mexBT announced the launch of its trading platform. The investment risk for Seedcoin was very high as meXBT was a start-up when it received the funding support. The currency's volatility added to the risk by making the value of the funding amount uncertain.

Joel Cano, Operations Director of mexBT, believes that a market as nascent as this one should not be slowed down by regulation. In March 2015, the UK government regulated bitcoin exchanges to prevent them from being used for money laundering. This initiative was applauded by the UK Digital Currency Association as being very important to increase the adoption of digital currencies.

Key lessons: meXBT, Mexico, 2014

- mexBT received funding in bitcoin from Seedcoin, an incubator, to develop a trading platform. Seedcoin's strong knowledge of bitcoin benefited mexBT. In very nascent markets it is important to select partners that have a strong market knowledge as this can determine the success of the start-up
- Governments can promote the development of the digital currencies market by implementing adequate regulation. This framework should protect the consumers and by doing so increase their trust and consequent adoption of digital currencies. Regulation in growth markets should enable innovation and not hamper growth

5.4 Charity or non-profit institutions

A number of charity or non-profit institutions are involved in financing businesses. The investments are normally related to the mission of the institution. Businesses eligible for this type of financing would be seen as drivers of economic and social development. Start-up companies are typically the beneficiaries of this type of support.

For entrepreneurs, this funding approach usually means not having to give up on equity from their business to the investor. The amounts made available by these institutions to businesses can vary significantly. Fundación Bavaria in Colombia claims to have financially supported 388 start-ups with USD8 million[119]. This support represents an average of USD22 000 per business. In the UK, Nesta, an innovation charity, supports businesses seeking first-phase investment of between GBP150 000 (USD235 379) and GBP1 million[120] (USD1 569 190).

The investment risk is usually high as it typically targets start-ups. However, risk taking is not necessarily driven by return on investment but rather by the expected socio-economic contribution from those companies. Local institutions are also expected to be more sensitive to the needs of local entrepreneurs. This initial support can provide the base for those businesses to develop and to become sufficiently attractive to other investors.

These funding initiatives can be driven by financial regulation. A common example is providing tax breaks to institutions that dedicate funds to support businesses or projects expected to have a positive social or economic impact.

5.4.1 Case study: Aentropico, Colombia

This case study was chosen as it demonstrates the importance of receiving grant funding early on in order to attract private-sector investment later in the process.

Aentropico is a 'big data' company that provides predictive analytics services to businesses. The company aims to make its service easy to use and as a result accessible to a large base of customers. This type of service is typically delivered over a web-interface and therefore requires a reliable broadband connection.

The company was founded in 2012 in Colombia. That year, Aentropico started its search for funding with a small team and a platform at a very early stage of development. It succeeded raising USD45 000 from private investors.[121]

In 2013 Aentropico raised USD110 000, of which USD20 000 was received from INNPulsa, a government-funded incubator,[122] and Fundación Bavaria, an institution that sponsors initiatives that are expected to have a positive socio-economic impact. Both institutions' mission is to support the growth of Colombia's business sector. The funds were offered to Aentropico as grants. Fundación Bavaria and INNPulsa were not expecting to receive a financial return. For Aentropico, this type of funding means that it does not have to

offer equity, which can be later used to attract investment from other parties or to retain ownership of the business.

The grants, together with funding received from investors such as Start-Up Chile and StartupBrasil, allowed Aentropico to keep growing its team and develop the platform. Today the company is selling its product to clients across Latin America.

Key lessons: Aentropico

- Grant funding from not-for-profit organizations means that companies do not have to relinquish any of their any equity or shareholding, which can be significant in attracting further private-sector investment
- Not-for-profit funding is particularly relevant during the initial stages of a business when it can be very challenging to attract private investors
- Governments can foster not-for-profit initiatives in different ways. A direct approach is to form agencies such as INNPulsa which help fill in the gaps where there are no private investors. Other less direct approaches could include rewarding companies that invest in projects of socio-economic importance with fiscal benefits

6 Conclusions

Based on the case studies presented in this report this section summarizes the key lessons and best-practice approaches to implementing regulatory frameworks and policies in order to attract investment in broadband networks and higher-layer services. This section also summarizes the investment trends across each of the case studies reviewed. However, care should be taken when interpreting these trends as the sample of case studies would need to be significantly greater to be statistically representative. Therefore the trends, at best, can be considered to be illustrative and would need to be tested further through further analysis and research.

6.1 Investment trends

This section summarizes the investment trends across each of the case studies reviewed in this report. By plotting the value of the investment of each case study (x axis) and the economic maturity of the region where the investment was made (y axis) it is possible to derive an investment trend for:

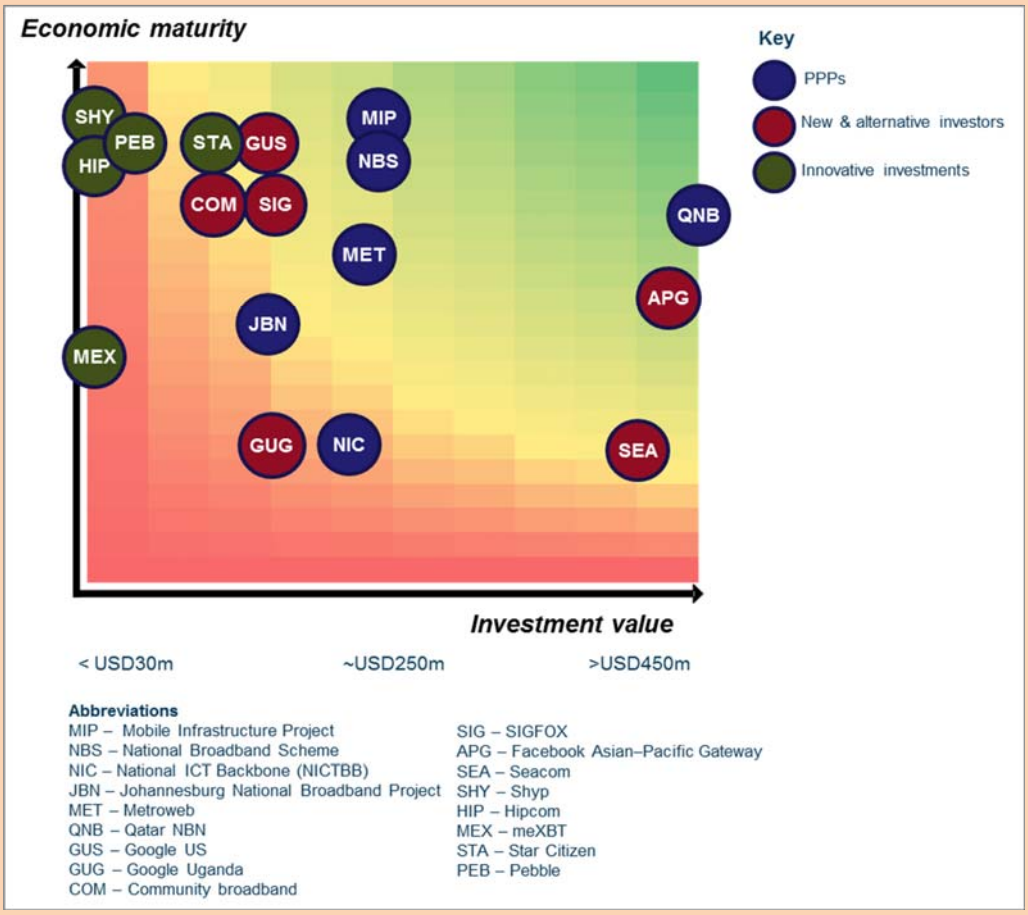
- traditional PPP broadband investments
- new market entrants and alternative investors
- innovative investors financing higher-layer services.

This results in the chart in Figure 6.1. As previously mentioned, however, care should be taken when interpreting these trends as the sample size is small and not statistically representative. Therefore the trends, at best, can be considered to be illustrative and are by no means conclusive. However, it is interesting to make the following observations and implications upon investing in broadband networks:

- PPP investments in developing and developed markets are largely similar in value, e.g. ranging from around USD100 million to USD245 million. The exception is Qatar, which has access to significant funds. This would suggest that investments are of a similar scale, however investments made in developing markets are likely to focus on achieving different outcomes to those in established economies. For example, PPPs in developing markets are largely focused on building core national infrastructure, while in developed markets PPPs are focused on maximizing last-mile broadband coverage to rural areas and in increasing broadband speed.

- In contrast to PPPs, investments made by new market entrants and alternative investors tend to have a greater vertical and horizontal spread to traditional PPP investments. The horizontal spread suggests that these investors are prepared to invest in higher-value broadband projects as well as those of lower value. The vertical spread suggests that the alternative investors are equally likely to invest in developing and developed markets.
- Investment in higher-layer services is predominant in developed markets. This is partly due to the maturity of the Internet ecosystem in developed markets which fosters technical innovation and investment. With the exception of crowdfunding, these investments have initially attracted low amounts of funding, suggesting that most of these options would currently be unsuitable for investment in any significant broadband infrastructure project.

Figure 6.1: Summary of investment trends



Source: Analysys Mason, 2015. Note figures are not abailable for MGTS

6.2 Summary of best-practice regulatory considerations

Based on a review and critique of the case studies presented in this report, the following considerations have been identified:

- Regulatory frameworks have had a direct impact on government-funded broadband PPP projects where a national broadband infrastructure was being partly funded by the state or through other public funds. Often this resulted in the regulator mandating wholesale access to the infrastructure on an equal open-access basis. Regulators will play a key role in ensuring wholesale networks owned by dominant operators – particularly when funded by government or public funds – are made available on an open-

access and non-discriminatory basis to help reduce the costs and barriers for new market entrants wishing to invest in broadband infrastructure. Open access can be mandated by the regulator through a licensing process or by ensuring government fibre deployments are designed on an open-access basis to promote infrastructure competition.

- Rural interventions have largely resulted in wireless solutions being deployed due to the challenging economics of rural and hard-to-reach areas. Regulators played an important role in encouraging operators to explore alternative ways of reducing costs for wireless deployments. The interventions vary in their nature, from building shared passive infrastructure to regulators encouraging active radio infrastructure sharing and spectrum pooling. Regulators will need to set up processes to monitor the market to ensure operators are being treated fairly. They will also need to set out guidelines for sharing infrastructure and for pooling spectrum if these are being considered.
- Network-sharing deals (particularly for mobile operators) have been subject to much less onerous regulatory and competition reviews and conditions than in-market consolidation deals. A wave of network outsourcing deals has convinced regulators that networks and services can increasingly be seen as separate. End users benefit from improved coverage, particularly in rural areas, as it allows them to reduce operating costs and share ongoing investment in new sites.
- Regulators may play a role in directing investment or offering licenses to encourage broadband investment in those areas needing it most. Regulators can also ensure that performance standards are being met by licensed operators, that interconnect agreements are being upheld and that prices are competitive. In these cases regulators will need to set up processes to gather market information and monitor the market on a regular basis. Other less direct roles include facilitating information sharing by providing up-to-date broadband coverage and mapping data to allow infrastructure investment to be prioritized in those areas where market failure has occurred.

Regulators have also played a key role in making the market more attractive to new market entrants, leading to innovative approaches to broadband investment.

- Regulators can allow operators to decommission their copper networks, which can provide an attractive cash source to invest in broadband networks. However, this will only be possible in countries where wholesale services such as local loop unbundling (LLU) and bitstream services are not present. The existence of wholesale services can create barriers to this approach, as LLU and bitstream services may have to be preserved for a period of time.
- Regulators can also ensure that the market conditions are conducive to attracting investment from new entrants. For example, it is important for new entrants to be clear about the existing infrastructure (e.g. ducts, telephone poles) that can be used and the rules that guide its use. Other important aspects include having quick access to construction and permission licences.
- Regulators can consider granting permissions for pilots to attract market interest, in order to promote investment in new technologies. Reluctance from regulators to facilitate technical trials, particularly with wireless technologies, may result in investors being put off from investing in that region by the risk of interference with other wireless technologies.
- Regulators can also play a role in encouraging community broadband networks. In February 2015, the FCC, the USA communications regulator, allowed two community broadband providers in the states of Tennessee and North Carolina to expand the geographical provision of their services. The law in these two states had previously prevented such expansion from taking place.

Some of the regulatory factors which investors would consider as being particularly important are written about extensively in the report *"Trends in Telecommunications Reform",* published in 2009 by ITU.[123] These aspects are still valid considerations that regulators and governments should take into account when developing or considering regulatory policy.

Regulatory factors relevant for investors

- **Design of legal framework**: whether the telecoms act or law recognizes the existence of a regulator and defines its role, scope of responsibility, accountability and market objectives.
- **Licensing regime**: the extent to which licence obligations are transparent and come with additional burdens such as administration, reporting, fees and the flexibility to adapt to new legislation.
- **Interconnection regime**: whether there is a well-designed and implemented interconnection regime that protects investors from below-cost interconnection payments from operators or unreasonable rates from regulators.
- **Regulatory fees and taxation**: whether there are excessive fees and taxes which can increase operating costs and discourage innovation and further investment.
- **Universal service funds (USF)**: whether operators are obliged to contribute to USFs and have the ability to access USFs to fund investment in areas of market failure.
- **Competition policy:** the effectiveness of the regulator to protect new operators against the abuse of market power from existing dominant operators and to promote fair competition through non-discriminatory wholesale open access to dominant operator infrastructure.
- **Tariff regulation:** the ability of the regulator to implement tariff regulation in developing regions or in the provision of services where there is ineffective competition.
- **Spectrum management**: whether scarce spectrum is over-priced and overburdened with coverage obligations, therefore decreasing the capital available to operators to invest in infrastructure.

Abbreviations

ARPU	average revenue per user
DBO	design, build and operate
FCC	Federal Communications Commission
FTTH	fibre to the home
FTTP	fibre to the premises
GPON	gigabit optical passive network
ICT	information and communication technologies
ISPs	Internet service providers
LLU	local loop unbundling
MNOs	mobile network operators
MTR	mobile termination rate
NGOs	non-governmental organizations
POPs	points of presence
PPPs	public–private partnerships
SAQ	subscriber acquisition costs
SPV	special purpose vehicle
WAN	wide-area network

Annex 1 – Procurement principles

Fairness and equitability

Fairness and equitability require that a procurement process be procedurally fair and non-discriminatory. The procurement specification and decision-making criteria (evaluation criteria) should not favour any particular bidders. Also, the procurement specification should be written in a manner that is technology-neutral, i.e. defines a clear set of output requirements and service quality standards independent of the technology used to achieve these requirements. All participants in the procurement must be given the same information prior to and during the process, including any clarifications or modifications to the specification or to decision-making criteria.

Transparency

Transparency requires openness throughout the entire procurement process. The process should be undertaken in a transparent manner, in public and not behind closed doors. All information regarding the tender specification and the procurement process must be made available and accessible to all potential bidders prior to, during and after the process. For example, a pre-tender information notice published on a central website or leading broadsheet newspaper can be used to alert all potential bidders to the intended procurement.

In addition, bidders should be given access to a publicly available detailed broadband network coverage map to demonstrate where public investment will *not* be targeted, i.e. where broadband networks are already available. This exercise should be conducted as an open market consultation.

The requirement specification and decision-making criteria should be made clear and adhered to throughout the procurement process, to demonstrate transparency in the tender requirements and in the awarding of the contract. Upon selection of a preferred bidder, where government aid is involved, a contract award notice should be published detailing the name of the beneficiary, the amount of aid to be provided, the intensity of aid and the technology chosen.

Competitiveness

Bidders should be selected on the basis of a competitive procurement procedure, to minimize the need for public subsidy. Projects involving public subsidy can be particularly complex to procure. In Europe, a competitive dialogue procedure has been designed that improves communication between the contracting authority (in this case the government) and bidders. This can lead to better designs and innovative solutions. Competitive dialogue can also increase competitive tension and allows better value to be extracted from bidders. However, competitive dialogue can be complex (see Figure A.1) and costly in terms of time and procurement resources, and therefore other options should also be considered.[124]

Figure A.1: Overview of competitive dialogue process

Source: Analysys Mason, 2015

Where government subsidy is awarded – following a competitive procurement – to an already dominant operator or an operator that may subsequently become dominant, this may limit market competition. Therefore public network procurements should enable competing operators or retail service providers to offer competitive and affordable services to end users. The award criteria should favour bids proposing wholesale or passive network models.

Cost-effectiveness

A government entity should try to procure the equipment for the broadband network at the lowest possible cost, and get value for money. This can be achieved by selecting a bidder on the basis of a competitive procurement procedure (as described above) based on those offering the most economically advantageous offer. This approach is contrasted to awarding a contract to the bidder with the lowest cost – which does not take non-price-related criteria into account. Consequently the evaluation of a tender should not exclusively depend on cost alone. The relative weight between price and other criteria will vary. Bidders should be advised in advance in an open and transparent manner of the weighting given to cost, and the other criteria against which their tenders will be evaluated. Such criteria may include, for example:

- geographical coverage
- broadband speeds offered
- competitive wholesale pricing
- projected initiatives to stimulate broadband take-up
- sustainability of the technological approach
- proposed re-use of existing infrastructure
- impact of the proposed solution on competition in the market.

Value for money can be achieved in a number of ways, for example by:

- Writing procurement specifications in output terms, enabling suppliers to consider and recommend cost-effective solutions that meet the requirements.
- Ensuring that the requirements are met but not exceeded – e.g. bidders may propose building a network in an area that is not considered to be a priority. Making network coverage maps available will be vital as part of this process.
- Introducing longer-term incentives into the contract to ensure continuous cost and quality improvements are made to the broadband network throughout its lifetime.
- Optimizing the cost of delivering the network over a longer-term contract such as 15 years or more.

Use of existing infrastructure

Bidders should be encouraged to re-use existing infrastructure (where this is fit for purpose) to avoid infrastructure duplication and reduce the amount of State subsidy required. The government should consider setting up a national database containing information on the availability of existing infrastructure that could be re-used for broadband roll-out.

Demand and rights of way

All efforts should be made to not only aggregate demand from government, but to also enforce rights of way. Demand aggregation can encourage operators to make broadband infrastructure investments in regions that they may otherwise consider as being commercially unviable. By demonstrating the demand for broadband services, operators may be convinced that there is a commercial case for investment.

Governments and regulators can also take steps to ensure that operators are not put off making investments in broadband infrastructure due to the high cost of acquiring the rights of way to lay fibre and due to the length of time it can take for a rights of way application to be processed.

For example, the Nigerian Ministry of Communications and Technology announced in June 2013 that it had reduced the time for a rights of way application to be processed and reduce the cost per km to help with the implementation of its national broadband plan. [125]

Annex 2 – Sources

Case study: Mobile Infrastructure Project (MIP), UK, 2011

Sources:

- http://www.ispreview.co.uk/index.php/2014/12/gbp150m-uk-mobile-infrastructure-upgrade-project-makes-slow-progress.html
- https://www.gov.uk/government/policies/making-it-easier-for-the-communications-and-telecoms-industries-to-grow-while-protecting-the-interests-of-citizens/supporting-pages/improving-mobile-coverage

Case study: National Broadband Scheme (NBS), Ireland, 2007

Sources:

- http://ec.europa.eu/competition/state_aid/cases/221646/221646_729738_49_2.pdf
- http://www.thejournal.ie/national-broadband-scheme-ending-1609666-Aug2014/

Case study: National ICT Broadband Backbone (NICTBB), Tanzania, 2010–14

Sources:

- http://www.nictbb.co.tz/news.php
- http://www.telecompaper.com/news/ttcl-to-supply-bandwidth-to-neighbouring-countries--886443

Case study: Qatar National Broadband Network (QNBN), Qatar, 2011

Sources:

- http://www.telecompaper.com/news/qnbn-pledges-to-have-fibre-optic-network-in-qatar-by-2015--901175
- http://www.gulf-times.com/qatar/178/details/374129/ambitious-plan-for-high-speed-broadband
- http://qnbn.qa/qnbn_release/heads-of-agreement-announced-between-qnbn-vodafone-qatar/

Case study: MGTS, Russia, 2013

Source:

- http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/

Case study: Google Fiber, USA, 2012

Sources:

- http://www.businessinsider.com/the-cost-of-building-google-fiber-2013-4?IR=T
- http://www.cnet.com/uk/news/google-to-test-ultrafast-broadband-to-the-home/
- http://www.technologyreview.com/news/510176/when-will-the-rest-of-us-get-google-fiber/
- http://www.techrepublic.com/article/comcast-time-warner-take-on-google-fiber-in-kansas-city-can-the-incumbents-compete/
- http://www.theverge.com/2015/2/17/8050935/att-google-fiber-kansas-city-gigapower-internet-price-match

- http://www.fastcompany.com/3036659/elasticity/lessons-from-googles-first-rollout-of-google-fiber

Case study: Google Fiber, Uganda, 2013

Sources:

- http://www.google.com/get/projectlink/
- http://www.iwayafrica.com/iwayafrica-uganda-launches-high-speed-fibre-access-to-sme-customers/
- http://www.ibtimes.com/google-goes-africa-why-western-tech-giant-digging-kampala-uganda-1487814
- http://www.technologyreview.com/news/521801/google-tries-to-turbocharge-internet-service-in-uganda/
- http://www.ibtimes.com/google-goes-africa-why-western-tech-giant-digging-kampala-uganda-1487814
- http://telecoms.com/200521/uganda-is-next-stop-for-google-fibre-project/

Case study: Elliot Management, USA/SIGFOX, France, 2015

Sources:

- http://www.reuters.com/article/2015/02/11/us-sigfox-fundraising-idUSKBN0LF06720150211
- http://www.fiercewireless.com/tech/story/iot-startup-sigfox-launching-902-mhz-network-nationwide-us/2015-03-03

Case study: Convergence Partners, South Africa/Seacom, 2009

Sources:

- https://manypossibilities.net/african-undersea-cables/
- http://www.pidg.org/impact/case-studies/seacom-undersea-cable

Case study: Asia–Pacific Gateway, Malaysia and Japan, 2012

Sources:

- http://www.bbc.co.uk/news/technology-18725728
- http://www.cnet.com/uk/news/intra-asian-submarine-cable-system-going-live-in-2015-as-koreas-kt-hooks-up/
- http://www.pcworld.com/article/258844/facebook_buys_a_stake_in_450m_asian_undersea_cable_consortium.html
- https://www.time.com.my/aboutus/newsroom_detailed.asp?id=236&ddlYear=2015
- http://www.thanhniennews.com/tech/intl-connections-in-vietnam-may-fully-recover-in-3-weeks-42574.html

Case study: Community broadband, Germany, 2008, 2010 and 2012

Sources:

- http://www.governancereport.org/home/governance-innovations/featured-innovations-2014/broadband-crowdfunding-germany/
- https://books.google.co.uk/books?id=XlL1AgAAQBAJ&pg=PA86&lpg=PA86&dq=crowdfunding+broadband+germany&source=bl&ots=RvNI8TVdFr&sig=5

- http://www.breitbandnetzgesellschaft.de/die-initiative/ausbauplan/

Case study: Star Citizen, USA, 2012

Sources:

- https://www.kickstarter.com/projects/cig/star-citizen
- https://robertsspaceindustries.com/funding-goals
- http://www.itworld.com/article/2694217/networking/internet-operators-explore-improving-african-interconnections.html
- http://www.crowdfundinsider.com/2014/11/55071-brief-star-citizen-creator-discusses-crowdfunding-video-games-development-video/
- https://ignitiondeck.com/id/crowdfunding-a-video-game/
- https://www.kickstarter.com/help/fees?country=GB
- http://www.cnbc.com/id/102021804
- https://www.kickstarter.com/projects/cig/star-citizen/description
- http://www.polygon.com/features/2015/3/2/8131661/star-citizen-chris-roberts-interview

Case study: Pebble, USA, 2015

Source:

- https://www.kickstarter.com/projects/597507018/pebble-time-awesome-smartwatch-no-compromises/description

Case study: Shyp, USA, 2013–14

Sources:

- http://blog.angel.co/
- https://medium.com/@kevingibbon/how-we-built-shyp-on-angellist-and-raised-2-1m-1c723714f713
- https://medium.com/@kevingibbon/how-we-built-shyp-on-angellist-and-raised-2-1m-1c723714f713
- http://www.fca.org.uk/static/documents/crowdfunding-review.pdf

Case study: Hipcom, UK, 2015

Source:

- https://www.pensionledfunding.com/case_study/hipcom/
- https://www.pensionledfunding.com/press_release/10-things-you-need-to-know-aboutpension-led-business-funding/

Case study: meXBT, Mexico, 2014

Sources:

- http://www.coindesk.com/seedcoin-gives-btc-sx-500-bitcoins-funding/
- https://www.cryptocoinsnews.com/mexican-bitcoin-exchange-mexbt-launches-trading-platform/
- http://www.coindesk.com/bitcoin-startup-incubator-seedcoin-raises-2000-btc-funding-round/
- https://www.cryptocoinsnews.com/mexican-bitcoin-exchange-mexbt-launches-trading-platform/

- http://eleconomista.com.mx/tecnociencia/2015/04/06/mexbt-quiere-llevar-bitcoins-mundo-reglas-innovacion
- http://www.independent.co.uk/life-style/gadgets-and-tech/news/bitcoin-government-to-regulate-cryptocurrency-to-avoid-money-laundering-says-treasury-10117566.html

Case study: Aentropico, Colombia, 2012

Sources:

- http://thenextweb.com/la/2013/12/28/12-latin-american-startups-look-2014/
- http://lavca.org/2014/01/29/entrepreneur-profile-sebastian-perez-saaibi-ceo-juan-pablo-marin-diaz-cio-aentropico/

List of endnotes

[1] Telecoms services market is defined as retail and wholesale, fixed and mobile voice and data services

[2] Source: https://www.itu.int/net/pressoffice/press_releases/2014/23.aspx

[3] Includes fibre to the cabinet (FTTC), fibre to the building (FTTB) and fibre to the distribution point (FTTdp)

[4] Analysys Mason FTTx roll-out and capex worldwide: forecasts and analysis 2014–2019

[5] Includes all deployments in which fibre runs all the way to the subscriber's premises. FTTH includes passive optical network (PON) and point-to-point (PTP) architecture, and includes (despite the acronym) broadband fibre connections to business sites. However, it does not include uncontended dedicated fibre-leased lines.

[6] ITU, World Telecommunication/ICT Indicators database and Measuring the Information Society report, 2014, http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

[7] LTE-A LTE Advanced is a mobile communication standard and a major enhancement of the Long Term Evolution (LTE) standard

[8] Source: Analysys Mason Global Telecoms Market Interim Forecast update 2014–2019

[9] Source: Analysys Mason public small cells worldwide forecast and analysis 2015 to 2020

[10] Public Wi-Fi is Wi-Fi service provided in public areas, such as retail districts, tourist attractions, food chains, coffee shops, business districts, railway stations etc. Private W-Fi is service provided within a home or business intended for use by the home occupants, or by employees of the business.

[11] Source: Analysys Mason, 2015

[12] See http://www.analysysmason.com/About-Us/News/Insight/France-consolidation-Jun2014/#17%20June%202014

[13] See http://www.zdnet.com/article/middle-east-africas-mobile-giants-take-first-steps-on-sharing-networks-to-cut-costs-boost-rural-coverage/

[14] See http://www.growthbusiness.co.uk/news-and-market-deals/business-news/2443992/david-cameron-heralds-growth-of-londonand39s-tech-city-on-threeyear-anniversary.thtml

[15] See http://www.londonandpartners.com/media-centre/press-releases/2014/12032014-tech-city-launch

[16] See http://www.techcityuk.com/investors/#investor-top

[17] See http://www.ispreview.co.uk/index.php/2015/01/virgin-media-business-brings-faster-broadband-londons-tech-city.html

[18] See http://www.theguardian.com/business/2014/jul/30/bt-trial-broadband-system-london-slow-tech-city

[19] See http://techcitynews.com/2015/03/26/uk-accounts-for-42-of-european-fintech-deals-in-2014/

[20] Seehttp://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf

[21] See http://www.analysysmason.com/About-Us/News/Press-releases1/Broadband-PPP-projects-Oct2012/#03%20October%202012

[22] It defined PPP as referring to any project where there is a mix of private- and public-sector involvement.

[23] See https://www.gov.uk/government/publications/2010-to-2015-government-policy-communications-and-telecomms/2010-to-2015-government-policy-communications-and-telecomms

[24] See http://www.superfastcornwall.org/

[25] See http://gov.wales/topics/businessandeconomy/broadbandandict/broadband/ngbw/?lang=en

[26] See http://www.ncc.gov.ng/thecommunicator/index.php?option=com_content&view=article&id=787:ncc-announces-mainone-ihs-winners-of-infraco-licence&catid=117:editorials&Itemid=5

[27] See http://www.skmm.gov.my/Sectors/Broadband/National-Broadband-Initiative.aspx

[28] See http://www.senado.gov.br/noticias/Jornal/emdiscussao/banda-larga/telebras.aspx

[29] See http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/rural-broadband-initiative

[30] See https://www.itu.int/osg/spu/ni/3G/casestudies/sweden/Sweden_fin3.doc

[31] See http://www.ispreview.co.uk/index.php/2014/12/gbp150m-uk-mobile-infrastructure-upgrade-project-makes-slow-progress.html

[32] See http://www.ispreview.co.uk/index.php/2014/12/gbp150m-uk-mobile-infrastructure-upgrade-project-makes-slow-progress.html

[33] See http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr12/telecoms-networks/uk-5.20and5.21

[34] See http://www.thejournal.ie/national-broadband-scheme-ending-1609666-Aug2014/

[35] See http://www.thejournal.ie/national-broadband-scheme-ending-1609666-Aug2014/

[36] See "Broadband now available in every district in Ireland", http://www.dcenr.gov.ie/Press+Releases/2010/Broadband+now+available+in+every+district+in+Ireland.htm

[37] Source: EU Digital Agenda for Europe (DAE) Scoreboard, 2014

[38] See http://www.slideshare.net/CommonwealthTelecommunications/broadband-infrastructure-development-challenges-in-tanzania

[39] See http://www.joburg.org.za/index.php?option=com_content&task=view&id=1223&Itemid=168

[40] See http://www.auvergnetreshautdebit.fr/qui-sommes-nous/
[41] See http://www.dcenr.gov.ie/Communications/Communications+Development/Metropolitan+Area+Networks/
[42] See http://www.shetland.gov.uk/news-advice/ShetlandIslandsCouncil-InformationBulletins-TelecomCableInfrastructure.asp
[43] See http://www.digitalregion.co.uk/
[44] See https://broadbandeurope.wordpress.com/public/
[45] See http://projectisizwe.org/funding-for-free-wifi/
[46] See https://www.westerncape.gov.za/speech/state-province-address-2014
[47] See http://www.balancingact-africa.com/news/en/issue-no-602/top-story/tanzania-government/en
[48] See http://waset.org/publications/9997991/the-impact-of-nictbb-in-facilitating-the-e-services-and-m-services-in-tanzania
[49] See Analysys Mason Tanzania telecoms market report 2015.
[50] See http://www.fin24.com/Tech/News/Joburg-takes-back-control-of-broadband-project-20150219
[51] See http://www.iol.co.za/news/south-africa/gauteng/r1bn-joburg-broadband-project-under-fire-1.1741234#.VV7uLbnbJ_I
[52] See http://www.fin24.com/Tech/News/Joburg-takes-back-control-of-broadband-project-20150219
[53] See http://www.eib.org/epec/resources/epec_broadband_en.pdf
[54] See http://www.reti.regione.lombardia.it/cs/Satellite?c=Redazionale_P&childpagename=DG_Reti%2FDetail&cid=1213693098477&packedargs=NoSlotForSitePlan%3Dtrue%26menu-to-render%3D1213542547392&pagename=DG_RSSWrapper
[55] See http://www.ghana.gov.gh/index.php/news/1293-president-mahama-inaugurates-38-million-fiber-optic-backbone-project
[56] See http://allafrica.com/stories/201305270024.html
[57] See EU Scoreboard, based on June 2014 data
[58] See https://www.telegeography.com/products/commsupdate/articles/2015/04/01/metroweb-looks-at-two-new-fibre-markets/
[59] See http://www.telecompaper.com/news/metroweb-plans-to-expand-network-to-two-more-cities-report--1074238
[60] See https://www.telegeography.com/products/commsupdate/articles/2014/11/20/telecom-italia-still-circling-metroweb/
[61] See http://www.qnbn.qa
[62] See http://www.nbnco.com.au/
[63] See http://www.gitpa.es/en/the-asturcon-network.html
[64] See http://www.stokab.se/In-english/
[65] See https://broadbandeurope.wordpress.com/jv/
[66] See http://www.csipiemonte.it/web/en/documentazione/documentation-en/profile-en/592-brochure2014/file
[67] See http://www.investintrentino.it/Government/Infrastructures-and-strategic-projects/Telecommunication-infrastructures
[68] See http://www.elard.eu/elard/national-leader-networks/en_GB/lithuanian-rural-communities-union
[69] See http://qnbn.qa/qnbn_article/delivering-on-the-vision/
[70] See http://qnbn.qa/qnbn_article/delivering-on-the-vision/
[71] See http://qnbn.qa/qnbn_article/delivering-on-the-vision/
[72] See https://www.telegeography.com/products/commsupdate/articles/2014/10/03/vodafone-qatar-agrees-to-buy-qatar-national-broadband-network/
[73] See more detail at http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/#28%20October%202014
[74] See http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/#28%20October%202014
[75] See http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/#28%20October%202014
[76] See http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/#28%20October%202014
[77] See http://www.analysysmason.com/Research/Content/Viewpoints/Copper-decommissioning-costs-Oct2014-RDTW0/#28%20October%202014
[78] See http://www.forbes.com/sites/eliseackerman/2012/08/04/how-kansas-won-the-google-fiber-jackpot-and-why-california-never-will/
[79] See http://www.businessinsider.com/the-cost-of-building-google-fiber-2013-4?IR=T
[80] See http://www.techrepublic.com/article/comcast-time-warner-take-on-google-fiber-in-kansas-city-can-the-incumbents-compete/
[81] See http://www.theverge.com/2015/2/17/8050935/att-google-fiber-kansas-city-gigapower-internet-price-match
[82] See https://fiber.storage.googleapis.com/legal/googlefibercitychecklist2-24-14.pdf
[83] See http://telecoms.com/200521/uganda-is-next-stop-for-google-fibre-project/

84 See http://www.gigaclear.com/gigaclear-secures-additional-6-5m-to-accelerate-rollout-of-gigabit-rural-broadband/
85 See http://techcrunch.com/2015/02/11/sigfox-raises-115m-to-take-its-internet-of-things-network-global/
86 See http://techcrunch.com/2015/02/11/sigfox-raises-115m-to-take-its-internet-of-things-network-global/
87 See http://www.convergencepartners.com/wp-content/uploads/SEACOMAnnouncement-ver3.pdf
88 Assumes an exchange rate of USD0.084 per ZAR
89 See http://remgro.com/wp-content/uploads/pdf/2015/Results_31Dec2014.pdf
90 See http://www.thanhniennews.com/tech/intl-connections-in-vietnam-may-fully-recover-in-3-weeks-42574.html
91 See http://www.pcworld.com/article/258844/facebook_buys_a_stake_in_450m_asian_undersea_cable_consortium.html
92 See https://www.time.com.my/aboutus/newsroom_detailed.asp?id=236&ddlYear=2015
93 See http://www.carnegieuktrust.org.uk/getattachment/49d067b8-5836-4906-bfe0-70978c6ca5e9/Rural-Broadband---Reframing-the-Debate.aspx
94 See http://www.hie.co.uk/community-support/community-broadband-scotland/funding/default.html
95 See http://www.governancereport.org/home/governance-innovations/featured-innovations-2014/broadband-crowdfunding-germany/
96 See https://books.google.co.uk/books?id=XlL1AgAAQBAJ&pg=PA86&lpg=PA86&dq=crowdfunding+broadband+germany&source=bl&ots=RvNI8TVdFr&sig=5#v=onepage&q=crowdfunding%20broadband%20germany&f=false
97 See http://www.breitbandnetzgesellschaft.de/die-initiative/ausbauplan/
98 See License-exempt framework refers to devices operating on a non-interference/non-protection basis in compliance with technical specification and/or band rules without the need for an individual device license. See ITU, Trends in Telecommunication Reform- special edition- 4th generation Regulation, Chapter 3 – TV white spaces: managing empty spaces or better managing inefficiencies? www.itu.int/specialtrends
99 See http://www.scotsman.com/news/scotland/top-stories/rural-scotland-to-lead-with-white-space-internet-1-3569913
100 See ITU, GSR14 Discussion paper on new frontier in spectrum licensing, http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2014/Discussion%20papers%20and%20presentations%20-%20GSR14/Session4_GSR14-DiscussionPaper-SpectrumLicensing.pdf
101 See https://www.crowdcube.com/pg/investing-your-money-1513
102 See http://www.crowdfiber.com/campaigns
103 See http://www.crowdfiber.com/service-provider-edition
104 See http://www.finextra.com/news/fullstory.aspx?newsitemid=27188
105 See the definition of accredited investors by SEC at http://www.sec.gov/answers/accred.htm
106 See http://www.crowdfundinsider.com/2014/11/55071-brief-star-citizen-creator-discusses-crowdfunding-video-games-development-video/
107 See https://robertsspaceindustries.com/funding-goals
108 See http://www.cnbc.com/id/102021804
109 See https://www.kickstarter.com/projects/cig/star-citizen/description
110 See http://www.polygon.com/features/2015/3/2/8131661/star-citizen-chris-roberts-interview
111 See https://www.pensionledfunding.com/press_release/10-things-you-need-to-know-aboutpension-led-business-funding/
112 See http://www.telegraph.co.uk/finance/currency/10686698/Bitcoin-exchange-MtGox-faced-150000-hack-attacks-every-second.html
113 See http://www.seedco.in/home/havelock/sf2
114 See http://www.howwemadeitinafrica.com/bitcoin-exchange-expands-to-kenya-sees-potential-in-using-m-pesa/47442/
115 See http://www.coindesk.com/california-regulator-coinbase-exchange-regulated-licensed/
116 See http://www.coindesk.com/seedcoin-gives-btc-sx-500-bitcoins-funding/
117 See http://www.coindesk.com/seedcoin-gives-btc-sx-500-bitcoins-funding/
118 See http://www.coindesk.com/bitcoin-startup-incubator-seedcoin-raises-2000-btc-funding-round/
119 See http://www.marketsgroup.org/news/destapa-futuro-and-angel-investment-in-colombia
120 See http://business.scotland.gov.uk/view/funding/nesta-venture-investment
121 See http://lavca.org/2014/01/29/entrepreneur-profile-sebastian-perez-saaibi-ceo-juan-pablo-marin-diaz-cio-aentropico/
122 See http://lavca.org/2014/01/29/entrepreneur-profile-sebastian-perez-saaibi-ceo-juan-pablo-marin-diaz-cio-aentropico/
123 See https://www.itu.int/pub/D-REG-TTR.11-2009
124 See EPEC, *Procurement of PPP and the use of Competitive Dialogue in Europe. A review of public sector practices across the EU*, available at http://www.eib.org/epec/resources/epec-procurement-and-cd-public.pdf.
125 See http://www.internationallawoffice.com/newsletters/detail.aspx?g=681de6db-6cb0-4064-b8f9-f1f3feb4059e

GSR discussion paper

Accelerating Broadband Deployment through Network Sharing and Co-investment

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 25 June 2015.

The views expressed in this paper are those of the author and do not necessarily reflect the opinions of ITU or its Membership.

Table of Contents

Page

Executive summary ..... **Ø**

1. Introduction 4
2. Advantages to governments of network sharing and co-investment 4
   - 2.1 Mobile sector 5
   - 2.2Fixed sector 5
   - 2.3Third party access 5
   - 2.4Comparison with single network operator deployment 5
3. Examples of network sharing and co-investment in practice 6
   - 3.1Mobile sector 6
   - 3.2Fixed sector 8
4. Reasons why there is not more network sharing and co-investment 9
   - 4.1Loss of independence 9
   - 4.2Partner selection 9
   - 4.3Difficulty in reaching agreement 9
   - 4.4Incumbent resistance 10
5. Ways governments can encourage or incentivise network sharing and co-investment 10
   - 5.1Government co-venturing 10
   - 5.2Use of spectrum licensing 11
   - 5.3Regulatory certainty 11
   - 5.4Mandated network sharing 12
   - 5.5Grants and subsidies 12
6. Downsides to governments of network sharing and cco-investment 12
   - 6.1Reduction in competitive intensity 12
   - 6.2Potential for collusive dealing and information sharing 13
   - 6.3Reduced options for services based competitors 13
   - 6.4SLA driven performance 13
7. Commercial models for sharing 13
   - 7.1Joint ventures 13
   - 7.2IRU access 13
8. Alternatives to sharing 14
   - 8.1Geographic split 14
   - 8.2Network hierarchy split 14
   - 8.3Third party outsourcing 14
9. Future applications of sharing and co-investment 14
   - 9.1Smart city environments 14
   - 9.2Virtualisation of core network infrastructure 15
   - 9.3Dynamic spectrum sharing 15
10. Learnings/recommendations 15

©ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Accelerating Broadband deployment through network sharing and co-investment

Author: Malcolm Webb, Partner, Webb Henderson

Executive summary

Most governments have as a key policy objective the increasing availability of affordable broadband services. New mobile and fixed broadband networks will need to be deployed to meet these policy objectives, yet these networks are expensive to build and the construction and demand risks are high. Achieving further and faster broadband deployment, particularly outside the main urban areas, is challenging and will require innovative solutions.

This paper examines the solution of network sharing and co-investment by multiple operators and potentially other sources, including the government itself, in building this new infrastructure. Commercially driven network sharing has been prevalent in the mobile sector, particularly in those countries with very competitive mobile markets, but it is still relatively rare in comparison for co-investment to occur in the fixed sector.

Governments are likely to favour sharing arrangements as a solution to the need for further and faster broadband deployment. Given this, we consider the case for governments to encourage and incentivise network sharing and co-investment. There are a number of advantages that should benefit consumers from successful sharing arrangements.

However, in examining options for encouraging and incentivising sharing, governments also need to take note of the fact that sharing arrangements are complex and have often proven difficult for operators to commercially agree in practice and a number have not survived for very long. This paper considers some reasons why, despite the cost and risk sharing benefits to operators, there have not been more enduring sharing arrangements.

Cognisant of this, we look at some ways in which governments can encourage and incentivise sharing. We particularly favour governments contributing assets and infrastructure, potentially through utilities, in co-venturing with private operators. There is also real benefit in governments providing high degrees of up-front certainty over the regulatory treatment of sharing arrangements for new network build.

Sharing of network infrastructure has such compelling logic if it can be made to work. We finish the paper with a look at some new ways in which network sharing may arise in the future, including through the emergence of smart cities.

1. Introduction

Governments around the world recognise that there are substantial societal benefits in the deployment of new broadband networks and services – 4G and fibre – and, for many governments, current levels of investment are not going as fast or as far as they require.

Governments need to acknowledge broadband networks are very expensive, particularly if deployed nationwide, construction risks can be high and returns for operators uncertain and may be limited. Creative and innovative thinking is required by governments to find ways to encourage investment by operators, and reduce the risks that they face, in deploying these networks and providing widespread broadband services on an affordable basis.

Governments have looked to address these challenges in several ways. Some governments have chosen to build broadband networks themselves (e.g., in the access network: NBN Co in Australia, QNBN in Qatar; in backhaul/backbone to rural areas: India, Argentina and Brazil). This sort of option is beyond the reach of many governments, particularly in access networks, but potentially less so in backhaul and backbone networks (e.g., in South Africa, a middle income country, the government has invested in backhaul/backbone through Infraco).

Other governments have chosen to incentivise a single operator to deploy the network, usually accompanied by a requirement to provide open access. Examples include the agreement between the Malaysian government and Telekom Malaysia to roll out a high speed broadband network and the agreement between the New Zealand government and Chorus to rollout a fibre to the home network.

In this paper, we consider whether governments should try an alternative approach and encourage or incentivise network sharing (the term commonly used in the mobile sector) and co-investment (the term commonly used in the fixed sector) by multiple operators and potentially other sources, including the government itself, as a solution to the "further and faster" challenge of broadband deployment.

2. Advantages to governments of network sharing and co-investment

Governments are likely to view network sharing and co-investment initiatives as being generally positive, particularly in those areas where there is limited scope for infrastructure competition. In most parts of most countries, there is limited scope for infrastructure competition in fixed access and in backhaul/backbone outside of the main routes. There is far greater scope for infrastructure competition in the mobile sector, but to a lesser degree in higher cost, low ARPU regions where it may only make sense to build a single mobile network.

We contrast in this paper the situation where a single network operator deploys a fixed or mobile network and is required to provide open access to third parties. Although this involves a sharing of infrastructure, we draw a distinction between this and the situation where multiple operators combine in a joint venture or other sharing arrangement to deploy the new network.

Sharing of infrastructure creates a new and different dynamic. It can change market structures. It is a shift from access to cost and risk sharing. It involves industry co-operation, rather than heavy handed regulatory oversight. It focuses on dynamic efficiency driven off the active layer and retail competition, rather than the passive layer.

And the logic of network sharing and co-investment will only improve over time, as the costs of passive infrastructure deployment (construction materials, labour, land etc) increase at the same time as the costs of active infrastructure reduce.

There are numerous statements from governments around the world that are encouraging of sharing arrangements. For example, as a component of the Digital Agenda, the EU Commission has stated that it specifically encourages fixed network sharing: "To foster the deployment of NGA and to encourage market

investment in open and competitive markets the Commission will adopt a NGA Recommendation based on the principles that…co-investments and risk-sharing mechanisms should be promoted."

2.1 Mobile sector

In the mobile sector, the main advantages to government of network sharing are:

- **Provision of services in higher cost areas**: By reducing costs and sharing demand risk, network sharing will encourage mobile operators to provide services in the higher cost, low ARPU areas where the business case for an own-build network does not stack up.

- **Planning and environmental**: Avoiding duplicate infrastructure, through sharing, is often important for planning and environmental reasons. Tall towers are an eyesore and communities are resisting a proliferation of new above-ground infrastructure. There may also be limited capacity or planning restrictions in roof top sites in urban areas.

- **Consumer benefits**: Lower overall costs for individual operators as a result of sharing, combined with a competitive retail market, should lead to price reductions and better value for money for consumers.

2.2 Fixed sector

In the fixed sector, governments will see equivalent advantages, but there are other features of fixed co-investment related to market structure that will be attractive to government:

- **New sources of investment**: These arrangements enable or facilitate investment into the industry from new sources (e.g., utilities, local government, infrastructure funds); e.g., sharing between telcos and utilities in Switzerland. These non-traditional players will benefit from partnering with operators (and vice versa). Non-traditional players usually have access to finance or valuable infrastructure or other assets which they can bring to the table and operators can contribute skills, capabilities, infrastructure and capital. We discuss the ways in which government, including through utilities, can encourage co-investment through in-kind contributions in section 5 below.

- **Industry co-operation**: Co-investment is a "big tent" approach, where industry players negotiate and co-operate in deployment and operation of the shared infrastructure. In the absence of anti-competitive concerns, a consensus-based outcome is usually superior to a regulated outcome.

- **Lessening of market power**: To the extent that the incumbent is a party to the co-investment arrangement, it can result in a lessening of market power, with a corresponding reduction in regulatory burden for the regulator and for industry.

2.3 Third party access

Government will often prefer, and sometimes require, open access if there are network sharing or co-investment arrangements. However, we believe a nuanced approach to this issue needs to be considered. If sharing operators are going to assume potentially substantial construction risk and demand risk in investing in new broadband infrastructure, then there is likely to be a case for a broader view by governments and regulators of open access. In section 5 below, we discuss regulatory certainty as a key way in which the government can encourage network sharing and co-investment.

2.4 Comparison with single network operator deployment

Whether co-investment models are superior to deployment by a single network operator, incentivised in some way by the government, may be open to debate. If the single network operator was required to

provide open access to other operators on a non-discriminatory basis, at cost-oriented prices, then co-investment alternatives may not be materially superior.

It is likely to be easier to put in place bilateral arrangements between the government and a single network operator, usually the incumbent in the fixed sector, for a speedy network roll out. However, the ongoing regulatory burden will not go away and may intensify with the single network operator model. There will still be the incentive, if the single operator participates in the downstream retail market, of discriminatory behaviour, favouring the operator's retail activities. All of this suggests that a sharing arrangement is more likely to lead to a reduced regulatory burden as compared to a single network operator model.

3. Examples of network sharing and co-investment in practice

3.1 Mobile sector

Commercial network sharing arrangements have been particularly prevalent in the mobile sector in developed and emerging markets. These arrangements have mainly been entered into voluntarily between mobile operators, with only fairly light-touch encouragement from governments. Today, it is said that around 15% of operators engage in network sharing of one sort or another.

Mobile network sharing is commonplace when powerful competitive pressures mean it's necessary for operators to share to reduce costs. This will usually arise in mobile markets where there are four or more infrastructure competitors. In these markets, we have seen substantial passive sharing and increasingly active sharing, including through use of third parties such as towercos.

Sweden was one of the earliest countries to take up mobile network sharing and it appears that these arrangements have been enduring.

Case study (Sweden): 3G mania swept through Sweden in 2000 and the result was that TeliaSonera, the incumbent operator, failed to win a 3G licence. It quickly sought an extraordinary network sharing deal with Tele2, which resulted in Tele2 transferring its 3G licence to a 50/50 joint venture vehicle. The 2001 joint venture was called Svenska UMTS-Nat AB (SUNAB).

As well as owning the spectrum, SUNAB has full ownership of the WCDMA network, including parts of the core network. The joint venture enabled each sharing operator to launch services and otherwise operate independently of the other. Each party bought wholesale capacity off SUNAB and in that sense is like an MVNO operating on the joint network. Capacity charges are the same for both operators.

The Swedish regulatory framework positively supported sharing arrangements. The 3G licences permitted the sharing of network covering up to 70% of population (the remaining 30%, in practice in urban areas, was to be independent).

At around the same time, in 2001, a 50/50 3G joint venture called 3GIS was entered into between 3 and Telenor (as successors to the original parties) in Sweden. Management and operation of 3GIS has been outsourced to Nokia Siemens Networks.

In 2009, Telenor and Tele2 formed a 50/50 JV (Net4Mobility) for deployment of a LTE network. The joint venture participated in spectrum auctions and acquired 800MHz and 1.8GHz spectrum. The same supplier structure used in SUNAB was used with Net4Mobility. Net4Mobility also includes joint GSM and transmission networks.

Australia was also one of the earliest countries to adopt mobile sharing arrangements. However, for various reasons, these arrangements did not survive for very long.

Case study (Australia): The four network operators paired up in two WCDMA network sharing joint ventures in 2004. After 3 years, each of the operators began building their own 3G networks.

In 2003, Hutchison had a first mover advantage in WCDMA (2.1GHz) in urban centres of Australia. But in 2004, it gave up that advantage by entering into a network sharing deal with Telstra. It was intended to last until 2017, when the 3G licences expired.

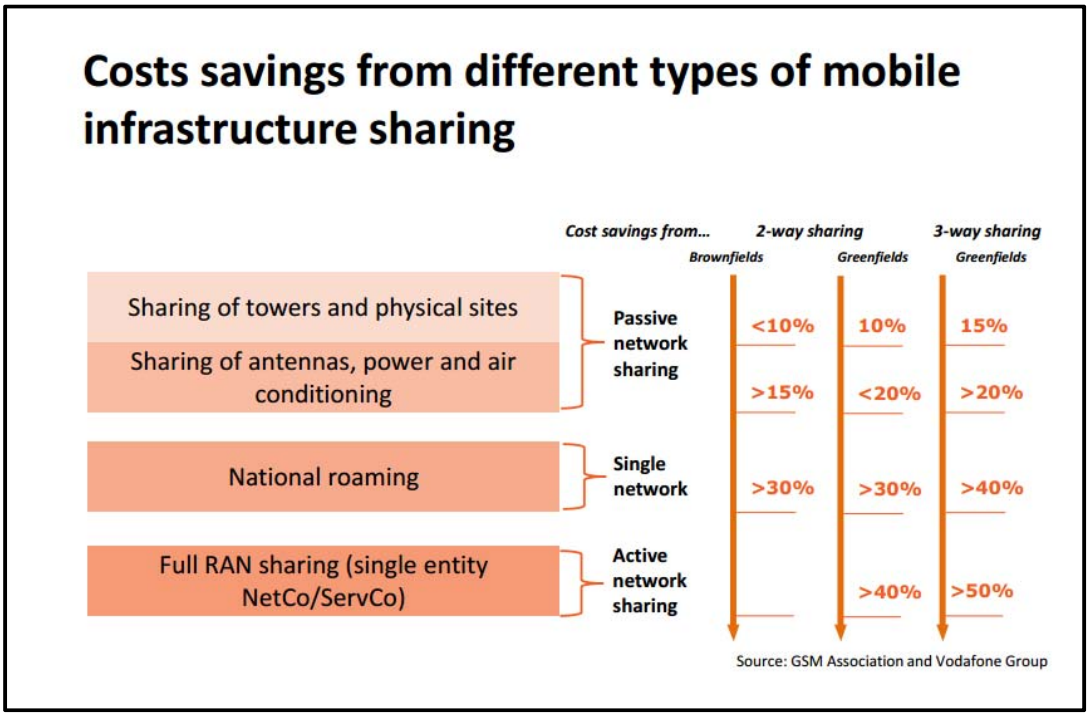
3GIS Pty Ltd was formed as a 50/50 joint venture. In consideration for 50% ownership of the joint venture, Telstra paid A$450m to Hutchison. 3GIS Australia involved a RAN share and a partly shared core, as well as shared frequencies.

Telstra launched its WCDMA services over 3GIS in 2005, but shortly after made the strategic decision to deploy a new WCDMA network (NextG) using 850Mhz spectrum, originally used in its CDMA network. Telstra launched NextG in 2006, meaning it was providing WCDMA services over two separate networks. With its lower frequencies, Next G had much greater coverage than 3GIS. Then, without much fanfare, 3GIS was closed down in 2012.

Weeks after the 3GIS joint venture was entered into in 2004, Vodafone and Optus decided to share their new WCDMA (2.1GHz) network, which was to be built from scratch. It was a RAN sharing (using MORAN), with each operator using its own spectrum and own core network, meaning it was not as integrated as the 3GIS Australia joint venture.

Around 2007, both Vodafone and Optus began to build their own 3G networks using both 2.1GHz and the lower frequency 900MHz bands that had become available for WCDMA. Vodafone subsequently merged with Hutchison to form VHA.

Most of the cost savings from network sharing (some say two-thirds) can be captured by sharing passive infrastructure. The cost savings from sharing active infrastructure are not as great, but they are still sizeable – delivering approximately 20-30% network cost savings for mobile networks. An approximation of cost savings from different types of mobile infrastructure sharing is shown below.



The pressure to share mobile networks is exacerbated by the explosion in consumer and business demand for data. Data is a lower margin business compared to earlier voice and messaging services, while at the same time the cost of running legacy networks is inefficiently high for dealing with high data volumes. New

LTE networks, which are optimised for carrying huge volumes of data, involve major new investments by operators.

Greenfields situations, that require entirely new networks, are generally considered to be easier and more suitable for sharing. This is one reason why we tend to see more network sharing deals in emerging markets than in developed markets. Although there is some sharing of existing assets, LTE is more greenfields in nature and this boosts the chances of a successful LTE network sharing deal.

3.2 Fixed sector

Co-investment in fixed markets occurs relatively infrequently, as compared to mobile network sharing. It is still fairly rare for co-investment agreements for fixed infrastructure to be entered into without some pressure or incentive by government to do so.

Case study (Netherlands): In an apparent example of a commercially driven co-investment arrangement, the Netherlands incumbent operator KPN had co-invested with Reggefiber to deploy FTTH connectivity to two million homes. The initial arrangement was that KPN would pay 41% and Reggefiber 59% of the deployment cost. However, in November 2014, KPN acquired 100% of Reggefiber, effectively bringing to an end the co-investment arrangement.

Case study (Singapore): Singapore's OpenNet was an example where there was an effective requirement to co-invest in order to benefit from a government incentive. The Singapore example was primarily driven by the policy objective of introducing a structurally separate entity at the passive layer and so a requirement that the fixed incumbent did not have a controlling stake in that entity. As a post-script, these co-investment arrangements were unwound in 2014, when all of the shareholders in OpenNet, including the incumbent, sold their interest in the company to NetLink Trust, a business trust where the incumbent is the beneficiary (to be sold down).

The other main instance where we have seen co-investment has been when competitors have gotten together to co-invest in a new network, without the involvement of the incumbent.

Case study (Portugal): Vodafone Portugal and Optimus entered into a long-term cooperation agreement, where each operator builds full Next Generation Access networks independently (mainly in Lisbon and Porto areas), with the agreement setting out conditions under which they may have access to (part of) the networks of each other.

However, these structures involving co-investment between competitors face the risk that the incumbent could adopt a cherry-picking approach and look to compete aggressively wherever the alternative co-investment entity is deploying. The very possibility of that strategy being used may deter competitors from co-investing in the first place.

In some markets, regulators have mandated network sharing in fixed networks.

Case study (France): In France, the regulator has mandated network sharing in respect of in-building wiring. This has resulted in operators that install in-building wiring to grant a passive access to other operators at the concentration point. Under the French IRU model, one operator signs a contract with the co-owners of a building and becomes the operator of the building. This operator is in charge of the construction and the maintenance of the network within the building, and offers passive access, either through a dedicated fibre line or through a shared fibre line, to other members of the co-investment agreement. Access is granted through long-term 30-year (or 24-year) cooperation agreements (granting of the IRU).

Planning and environmental considerations can also drive network sharing/co-investment, by pressuring a reduction in the passive infrastructure that can be built. This will increasingly be the case in urban areas, for tower structures, but also potentially underground works.

4. Reasons why there is not more network sharing and co-investment

Despite the apparent benefits to operators of network sharing and co-investment in terms of cost reductions and reduced demand risk, it's worth considering why it doesn't happen more often, or in other circumstances, and why a number of sharing deals don't seem to last.

There are several reasons why it has proven difficult for operators to commercially reach enduring network sharing or co-investment arrangements. The commercial dynamics of sharing are so complex - these obstacles need to be borne in mind by governments that are looking to encourage, or incentivise, sharing arrangements.

The reasons why it has proven difficult for operators to commercially agree enduring network sharing or co-investment arrangements include the following:

4.1 Loss of independence

With a sharing arrangement, it is inevitable that an operator will no longer have full control over network strategy and investment. An independent network operator can dictate the direction that its network will take, its rollout strategies and vendor choices. Network sharing involves ceding some of this control, in return for the benefits that are available.

This sometimes manifests itself in concerns that the sharing partner, who is also a competitor, will stymie new competitive developments in the shared network that the other operator wishes to make.

For a sharing deal to succeed it will be necessary for the operators to reach agreement on where full independence needs to be maintained, where agreement is required with the sharing partner and where operational and network control may be ceded.

These concerns over loss of independence mean that neutral or independent governance is critically important in network sharing transactions. This is one reason why separate joint venture structures are used and is said to be an added benefit of third party involvement (e.g., as an investor, an outsourced provider or independent JV management). The success of the towerco model is partly due to the neutrality that an unrelated third party management company can provide.

Neutral or independent governance means that a subset of decisions may be entrusted to the joint venture, without requiring agreement between the sharing parties. The need to reach agreement with the other operator over issues of when and where to invest in networks is likely to be time consuming and is a prime area for contentious disputes in the implementation of these transactions.

4.2 Partner selection

Having a compatible sharing partner will alleviate some of these concerns. The selection of a compatible partner involves considerations of whether there is an alignment on network evolution and deployment and investment plans and strategies. This is particularly the case with mobile network sharing.

As well as plans and strategies, a mobile operator with a similar network will mean that neither party has a material advantage over the other in entering into the arrangement. In contrast, when say a large operator and a new entrant are considering a network sharing deal, there can be real difficulties in reaching agreement on key issues such as valuation and allocation of benefits.

4.3 Difficulty in reaching agreement

It is never easy to reach agreement on a network sharing deal with a competitor, due to the healthy distrust that each management team has of the other. Shareholder support can be important in getting a sharing deal across the line, including incentives for management to put in place and then implement the arrangement.

A network sharing deal will often involve transfer of existing assets into a joint venture structure (or to a third party) and will often involve decommissioning of some sites. It is often said that disagreements over asset valuation is one of the main reasons why non-greenfields network sharing deals do not proceed.

Transfer pricing issues and service levels for ongoing services will also need to be resolved, as well as vendor strategy. This includes the role of third party vendors, which vendors will perform which functions (e.g., maintenance, repair, field services) etc. Although it will be difficult to exit a network sharing agreement, exit provisions also will need to be agreed.

4.4 Incumbent resistance

In the fixed sector, where there is not usually the intensity of infrastructure competition that is experienced in mobile, incumbents can be reluctant to depart from the status quo and consider novel co-investment options, particularly any options where they are likely to lose control.

5. Ways governments can encourage or incentivise network sharing and co-investment

To date, governments have generally encouraged, in a light-touch way, network sharing and co-investment. A number of countries have mandated network sharing, but there have been few examples of governments actively incentivising network sharing or co-investment.

In this section, we consider what steps governments could take to actively incentivise network sharing and co-investment.

5.1 Government co-venturing

Governments can play a significant role in fostering co-investment through co-venturing with private sector operators. We see this as one of the most important steps that a government can take to encourage broadband deployment, particularly in greenfields areas.

Governments have very valuable assets and infrastructure that, if made available, would speed up, and potentially reduce the cost of, broadband deployment. Governments can contribute assets, access to utility infrastructure or wayleaves etc.

It is not essential for governments to provide its in-kind contribution through a co-venture with private sector operators, but it is a key option. An auction could be used to determine private sector participation and the valuation of government contribution could, for example, be at replacement cost using modern equivalent assets. Alternatively, government in-kind contribution could be leased to a co-investment entity, rather than the government participating at an equity level.

Participation by public utilities in the rollout of next generation access can be a strategy that governments can pursue more actively. Co-investments are already happening between public utilities and private operators in European countries such as France, Germany and Switzerland. In Switzerland, the co-investment arrangements have been said to have increased competition in the market as well as facilitating deployment of next generation access networks.[1] Interestingly, in regions of Switzerland where public utilities have not entered, the incumbent operator hasn't shown the same levels of investment activity.

Case study (Ireland): In 2014, EDS (an Irish electricity utility) and Vodafone Ireland entered into a 50/50 incorporated joint venture to build and operate a wholesale only, open access fibre-to-the-building (FTTB) network to homes and businesses in certain parts of Ireland. The joint venture entity will deploy fibre on ESB's existing overhead and underground infrastructure in return for a fee from the joint venture. The joint venture will provide a wholesale virtual unbundled local access (VULA) product to retail operators, as well as a higher quality, point to point service suitable for mobile backhaul and business customers.

[1] Financing of the Roll-Out of Broadband Networks: Note by Switzerland (OECD, 16 June 2014) DAF/COMP/WP2/WD(2014)17.

Co-investment between a utility and a private sector operator avoids some of the obstacles referred to in the previous section around reaching agreement between competitors. Loss of independence will still be a concern for private sector operators, but potentially arrangements with utilities may permit operators a greater level of control over key network decisions than might be the case in a pure sharing arrangement between private operators.

It may not just be utilities that get involved in these sorts of activities. Other government entities with widespread infrastructure, such as road or railway entities, can be key partners for private sector operators looking to roll out new broadband networks. In emerging markets, where there is often a government policy priority to push out electricity, road and rail networks into more rural areas, there can be a particular synergy with telecoms operators in building broadband networks in the same areas at the same time.

5.2 Use of spectrum licensing

The dynamics are different in the mobile sector and a lighter-touch may be all that is required from the government to encourage network sharing. One of the most potent means available to the government is through 4G spectrum licensing conditions. This scarce spectrum is in high demand and, through licence conditions, governments can facilitate sharing. Licence conditions are not costless, as they may potentially reduce licence proceeds for the government.

As an example of how licence conditions may facilitate sharing, each licensee may be required to provide widespread nationwide coverage, but network sharing is permitted. This creates a strong incentive for licensees to share, particularly in higher cost, low ARPU areas. Alternatively, the licence conditions may require each licensee to build a network in rural areas in one part of the country, while allowing sharing or roaming in the rural areas where they have not built.

5.3 Regulatory certainty

We referred above to the question of whether sharing or co-investment arrangements that are entered into commercially should be subject to open access by third parties. This is a subtle issue. On the one hand, open access policies are usually thought to promote competition, but this has normally been in the context of existing networks with long-since sunk investment. When it comes to new investments, the risk of imposing stringent open access requirements, or the potential threat of it, may discourage operators from agreeing to invest in the first place.

This means governments can assist in providing high degrees of up front regulatory certainty for co-investing entities, to address the risk of regulatory intervention post sunk investment. Governments or regulators may be prepared, for example, to provide clarity that any access pricing will recognise the build and demand risk at the time of investment. One of the major concerns of investors in new broadband networks is that, if they build and it is a success, access will be imposed on terms that don't take into account the risks at the time of investment.

Other possible approaches include:

- long-term regulatory commitments, such as NBN Co's 27 year special access undertaking accepted by the Australian regulator, which provided high degrees of certainty for NBN Co;
- applying a utility-style regulatory asset base approach to the new broadband network, providing a revenue ceiling for the new entity;
- providing the sharing operators with a period of exclusivity, before being required to offer open access, which may be acceptable in recognition of the operators' commitment to invest and deploy the new network; and
- enabling the sharing operators to access at say the passive layer, with third parties being entitled to access at the active layer only, but otherwise on a non-discriminatory basis.

Regulators may more likely to be prepared to provide regulatory certainty to a shared entity, where no single operator has control, as compared to a new build, single owner model. At the very least, governments should review the regulatory environment to ensure there are no unintended roadblocks that may harm the potential for commercial network sharing and co-investment arrangements to arise.

5.4 Mandated network sharing

We have seen mandated mobile network sharing or roaming obligations being imposed by some regulators (e.g., Colombia, France, US) to encourage new entrants, often intended to be on a temporary basis and usually for the purposes of matching existing coverage, rather than increasing coverage. We can see merit in these situations in brownfields environments, but otherwise we are sceptical whether mandated network sharing is likely to be productive in encouraging greenfields investment.

Again, this may come down to regulatory certainty. As long as the investing operator building a new network in a greenfields environment has certainty of the basis on which mandated network sharing will be required before making the investment, then there can be little objection so long as they have the choice of whether to invest. But care is required that the regulator does not stymie investment in the first place by overly rigorous requirements for mandated sharing.

Case study (Indonesia): In Indonesia, the regulator, Kominfo, has restricted the construction of new towers in the vicinity of an existing tower in order to persuade operators to undertake infrastructure sharing. Under the terms of the regulation, a new tower can only be constructed if for some reason the existing tower cannot be shared. The regulation provides a guideline for the construction and development of joint mobile towers. Under the regulation, the owner of a mobile tower is required to give non-discriminatory access to other telecommunications operators. The tower owners are also required to give information in terms of the tower capacity to potential access-seekers in a transparent manner.

5.5 Grants and subsidies

There have been some particularly successful examples of the use of relatively modest grants and subsidies by government to overcome what would be expected to be stiff resistance particularly from fixed incumbent operators. We have referred to the Singapore example above where a co-investment arrangement arose from a government financial incentive. Although not a co-investment, the New Zealand ultra-fast broadband initiative, with the lure of a government grant that was tendered to deploy a fibre to the home network, was sufficient to incentivise the fixed incumbent to structurally separate in order to participate in the initiative.

6. Downsides to governments of network sharing and cco-investment

There are potential downsides for governments of network sharing and co-investment, but they are generally regarded as fairly manageable, in the right circumstances.

6.1 Reduction in competitive intensity

Reduction in competitive intensity can be a concern, as competition will be confined to the services layer, rather than services and infrastructure layers, with a sharing arrangement.

The common view that seems to have been taken by regulators is that, at least for passive network sharing in the mobile sector, there is little competitive benefit in pure coverage, so infrastructure sharing is unlikely to harm competition. Similarly, with most types of active network sharing in the mobile sector, so long as sharing operators have the ability to differentiate their services from one another, the impact on competition is fairly benign.

However, once there is integration at the infrastructure layer as a result of a sharing arrangement, it's very difficult to unwind, leading to potentially a permanent reduction in infrastructure competition.

6.2 Potential for collusive dealing and information sharing

There is the potential for collusive dealing between sharing operators (may be easier to establish a focal point and monitor/punish behaviour, plus limited outside pressure). Regulators need to carefully evaluate this issue and is likely to require ongoing monitoring.

Sharing of commercially sensitive information among co-investors is also a concern, but is an inevitable feature of sharing arrangements. Appropriately structured procedures/protocols can be implemented to reduce the competitive impact of this information sharing.

6.3 Reduced options for services based competitors

A reduction in infrastructure competition may lead to reduced options, and more limited capacity, available for services based competitors (such as MVNOs). This may not be such an issue where sharing operators retain their competitive independence and so the motivations for agreeing to enter into MVNO type arrangements should not change. Limited capacity could be an issue, but most sharing or co-investment arrangements would be expected to provide for sufficient capacity for sharing operators and potential services based competitors as well. If this remains a concern for regulators, they could require (and provide upfront regulatory certainty on) provisioning of sufficient capacity for services based competitors.

6.4 SLA driven performance

In the absence of infrastructure competition to drive efficiencies etc, there will be a requirement for SLA-driven performance to incentivise the shared network to perform. Depending on the effectiveness of the SLA regime, this can be effective in ensuring efficient operation of the network.

7. Commercial models for sharing

The main commercial models for network sharing and co-investment are joint ventures and long-term co-operation agreements (**IRU access**).

7.1 Joint ventures

Joint ventures are a common structure adopted for network sharing (usually incorporated, sometimes unincorporated). Normally, the joint venture owns, operates and maintains the joint network. In these circumstances, sharing operators contribute financial and human resources to the joint venture, although aspects may be outsourced to third party vendors. Sometimes it is only an asset owning JV. The joint venture may acquire assets from one or both sharing partners and will undertake joint build of the new network.

Joint ventures are also a feature of co-investment in fixed networks. In the Irish example referred to above, a 50/50 incorporated joint venture was formed between ESB and Vodafone Ireland. The parties each provided 50% of the share capital for the joint venture and 50% of the voting rights, with equal board representation. The joint venture has a management team dedicated to its day-to-day operations and each party committed to sufficient funding until the joint venture becomes self-funding.

7.2 IRU access

Indefeasible rights of use (**IRUs**) have been a feature of the telecommunications industry for many years, particularly for long haul transmission and subsea cables. Legally, IRUs are an arrangement by which a party acquires the right to use network infrastructure (such as dark fibre), or an amount of capacity (including transmission) or a network facility (such as ducts) for most of the life of the asset. IRU arrangements are often for around 25-30 years and are normally non-renewable.

As well as access to the main infrastructure, the IRU will usually also allow access to ancillary infrastructure, such as manholes and cabinets where duct access is provided, as well as colocation and access to splicing/junction nodes.

An IRU may be seen as a form of co-investment or network sharing. Through its up-front commitment, the acquirer of the IRU effectively shares the infrastructure with the grantor of the IRU and other IRU users. IRUs have been a particular feature of the French FTTH projects, referred to above. IRUs can also arise in mobile network sharing arrangements.

8. Alternatives to sharing

What are the alternatives to network sharing/co-investment?

8.1 Geographic split

Although not a classic network share, one operator could simply provide wholesale network services to another operator, which may include national roaming or MVNO services for example in the mobile context. This may arise where the parties agree that one operator will build, own and operate the network in one geographic area and allow the other to use the network, with the same arrangement in reverse in another geographic area.

This sort of arrangement can also apply in relation to fixed networks.

Case study (Switzerland): In Geneva, the utility SIG builds the access network in the agglomeration of Geneva and Swisscom builds the access network in the inner city. Dark fibre access is granted by both SIG and Swisscom to the other and the roll-out cost is split 60% Swisscom and 40% SIG.

8.2 Network hierarchy split

In the fixed network context, there are instances of one partner building the terminating segment and another building the backhaul segment.

Case study (Switzerland): In Switzerland, the utility usually builds the terminating segment (OTO-CP) and Swisscom builds the feeder and backhaul network (CP-ODF) and provides collocation. The partners exchange IRUs over their infrastructure.

8.3 Third party outsourcing

Another option is third party outsourcing, where the sharing operators transfer their assets and outsource the management and operation of their shared network to a third party vendor. This is an attractive arrangement as it removes aspects of trust issues that can complicate, for example, joint ventures.

More commonly, third party managed services for the management and operation of RAN, core and transmission networks are entered into with individual operators (about 25% of operators have entered into these arrangements). Equipment vendors such as Alcatel-Lucent, Ericsson, Fujitsu, NEC, Nokia, Huawei and KT Corp provide various types of third party outsourcing arrangements that may be suitable in a network sharing arrangement.

The involvement of a third party will reduce the savings available to the sharing parties and results in SLA-driven control of that third party. Outsourcing to a third party also involves loss of competence within the operator's organisation, which can have long term implications.

9. Future applications of sharing and co-investment

What are the future applications of the sharing and co-investment model?

9.1 Smart city environments

Extensive and ubiquitous high-speed connectivity is a key enabler for the success of smart cities. Telecoms operators (and perhaps disrupters to the telecoms sector) have the opportunity to provide connectivity solutions that allow users to consume smart city solutions.

Connectivity solutions will go beyond fixed and mobile broadband connectivity and extend to proximity connectivity using WiFi, NFC, Bluetooth, RFID and the like. There will also be a need for other progressive connectivity solutions.

It will be necessary for governments, telecoms operators, utilities and private entities to share and provide access to key infrastructure necessary for the proliferation of smart city solutions, such as buildings, cabinets and light poles. Sensors and other smart components may need to be installed in strategic locations that are owned by these parties, and it may make sense to make those sensors and components available for use by other players in the smart city ecosystem.

But it won't just be access to infrastructure that will need to be shared in smart cities. Data sharing and access will also play a critical part in the success of smart cities and in this case clear rules and perhaps regulatory intervention may be needed. For example, in the context of a smart emergency services solution, energy utilities may need to share smart grid data with emergency services agencies so that they can respond immediately – or even pre-emptively – to power outages or power-related emergencies on the basis of that data.

9.2 Virtualisation of core network infrastructure

We can expect cloud based infrastructure to be increasingly used by telecoms operators, in terms of their data centre, platform or application requirements to run their network. This is a form of sharing, as logical separation through virtualisation will mean it will be possible for core network infrastructure and functions to sit on physical infrastructure that is used by other parties and potentially other operators.

9.3 Dynamic spectrum sharing

Spectrum sharing is likely to increasingly feature in RAN and optical fibres (dynamic wavelength allocation). Traditionally, mobile network operators have been reluctant to consider spectrum pooling, or sharing of spectrum between operators, as they seek to maintain maximum flexibility to manage their networks and also because frequency allocations are often not equal. India, for example, does permit some RAN spectrum sharing, but it is not permitted in many countries.

Up until now, and for the foreseeable future realistically, governments allocate spectrum mainly on a dedicated basis. This has allowed operators to use higher power equipment, with resulting wider coverage, while limiting interference. The exceptions have been the unlicensed spectrum, used by (among other things) Wi-Fi networks.

Dynamic spectrum access (DSA) technologies allow devices to use spectrum where it is not being used in the particular geographic area, or at the particular time. This way, multiple users can "share" the spectrum, while minimising interference to others.

The greatest near term opportunities for deploying spectrum sharing are likely to be in those bands with substantial government uses, which are suitable for mobile broadband, but where clearing these government users off the spectrum cannot be done in a reasonable timeframe. In Europe, the 2.3GHz band is being considered for spectrum sharing between government and commercial users. In the United States, the FCC is considering shared access to the 3.5GHz military band for use by small cells.

10. Learnings/recommendations

Achieving "further and faster" broadband coverage is a key issue for most governments around the world. One of the options available to governments is to encourage or incentivise network sharing or co-investment. Achieving deployment of new broadband networks through network sharing and co-investment will bring a range of benefits for governments as compared to other options – little or no

investment may be required from government to make it happen, we could see speedier deployment, and we should see cost savings passed on to consumers and a reduced ongoing regulatory burden.

However, it is undoubtedly a challenge for sharing operators to create, implement and maintain a successful network sharing or co-investment arrangement. It is always difficult to clearly establish reasons why potential sharing arrangements do not go ahead and parties are loathe to publicly explain why sharing arrangements prematurely come to an end (e.g., in Australia). Nevertheless, given all the benefits that are available to operators, it is somewhat surprising that sharing does not occur more frequently.

It is clearly more difficult to achieve co-investment in fixed networks, where there is less infrastructure competition than in mobile. This is an area where government incentives, including in-kind contributions, could bring about a breakthrough. We can see particular merit in governments (including through utilities) co-venturing with telecoms operators to facilitate the rapid rollout of fixed broadband networks.

_____

GSR15 Discussion Paper

THE IMPACT OF TAXATION ON THE DIGITAL ECONOMY

The views expressed in this paper are those of the author and do not necessarily reflect the opinions of ITU or its Membership.

This discussion paper was prepared by Prof. Raul Katz under the direction of the International Telecommunication Union (ITU) Telecommunication Development Bureau (BDT) Regulatory and Market Environment Division.

It was presented at the ITU's 15th Global Symposium for Regulators, held at Libreville, Gabon, from 9 to 11 June 2015

Executive Summary

The purpose of this study is to review and discuss policy issues related to the taxation of firms operating within the digital sector, as well as levies imposed on consumers purchasing digital goods and services. As indicated in the title, its scope is wider than just telecommunication services, although it also addresses taxation of telecommunication operators.

A diversity of taxes is imposed on firms operating within the digital eco-system. To begin with, corporate taxes and value-added taxes are typically applied to all firms in the digital sector. In addition, import duties are generally imposed on all types of digital equipment, whether they are consumer-oriented (such as smartphones) or needed by infrastructure operators (such as switches and servers). Finally, a number of sector-specific taxes can be collected within the digital eco-system, either applied to the selling of digital goods (like video-streamed movies) or the ownership of wireless devices.

Telecommunication operators typically pay corporate taxes on profits, but are also expected to contribute at several levels (for example, import duties and sales taxes on equipment purchased from overseas suppliers, property taxes on buildings and land owned where equipment is installed). Beyond taxes imposed on telecommunication operators, Internet service providers (ISPs) can also be subject to sector specific levies (for example, conventional corporate taxes, sales taxes on initial equipment purchase, and property taxes for physical assets). In most cases, the burden of taxation is primarily borne by the operator, although in some cases taxes will be passed through to consumers, thereby increasing the cost of acquiring broadband service.

On the consumption side, wireless users in most countries pay taxes at the time of service acquisition (generally linked to handset activation) and on an ongoing basis (linked to service delivery). On the service side, most countries impose some form of value-added tax (VAT), a general sales tax or a similar consumption tax calculated as a per cent of the total monthly bill. Some countries also charge an additional special communications tax as a per cent of the service bill. Finally, some countries also charge a fixed tax that could be either driven by general communications or wireless usage. Beyond service taxes, levies can also be imposed on handset acquisition. Broadband consumption taxes, generally referred to as Internet Access Taxes, are not uniformly applied across countries. In some cases, since broadband is considered to be a critical need, regulators have chosen to exempt broadband service from any consumption tax. In other cases, governments consider the ever-growing Internet access an attractive source of revenue and therefore, subject to taxation.

Beyond telecommunication and broadband provisioning, taxation of other players in the digital value chain, such as digital advertisers, content over-the-top distributors, and electronic commerce platforms, presents numerous conceptual problems, which result in a much more diverse set of approaches. There is still no consensus among policy makers as to what category should digital goods fall into, or whether a digital good should be taxed at all.

The ongoing debate around taxation policy in the digital economy entails multiple issues:

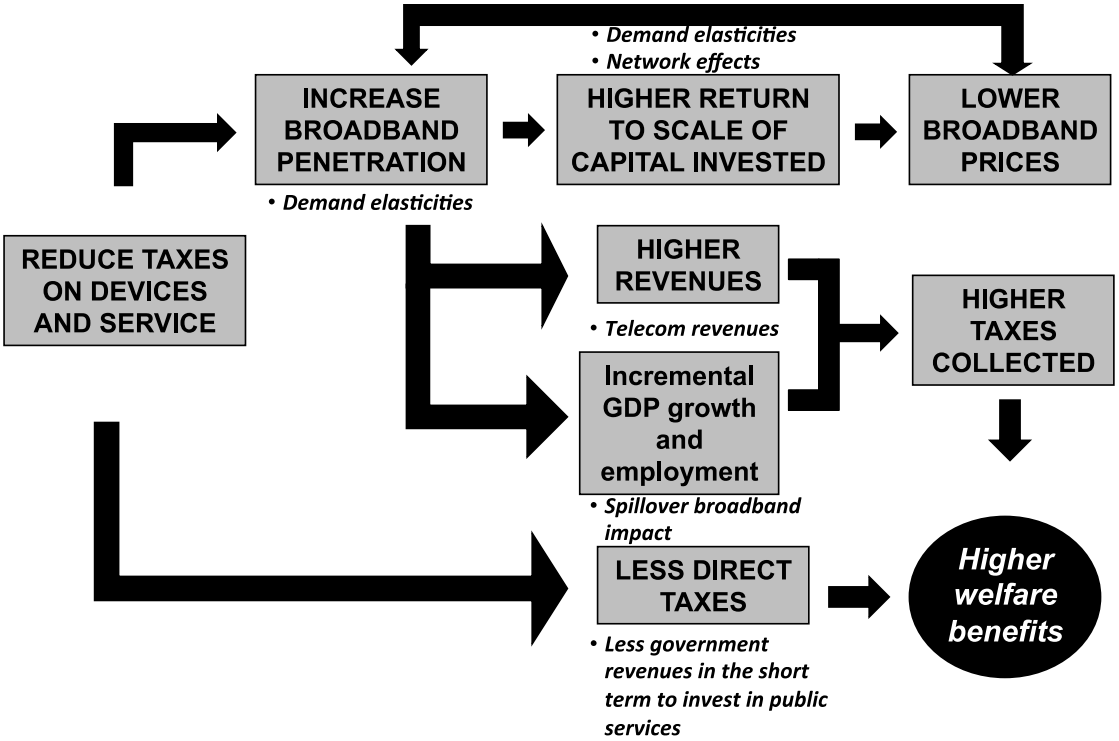
- What is the appropriate level of taxation on capital equipment purchased by telecommunication operators?
- How should Internet sales be taxed?
- How should consumption of digital goods be taxed?
- Should the consumer purchasing wireless devices and personal computers be taxed?
- Should the providers of digital platforms, such as Google and Facebook, be taxed at the country where revenues are generated, or should they benefit from international rules that allow them to take corporate tax exemptions in certain locations?

- Should Internet service providers pay taxes the same way as telecommunication carriers?

The list of issues could be extended, but the cases mentioned above serve to raise the point that taxation in the digital economy is one of the most important policy issues in today's environment. Valid policy arguments and trade-offs could be raised on every one of them.

At the highest level, two opposing trends can be detected in terms of digital taxation policy: one aims to maximize collections based on exponentially growing digital flows; the second one recognizes that lowering taxation benefits consumers and businesses, and consequently, economic growth. According to the first trend, governments recognize that digitization is critical in their generation of revenues and are putting in place more mechanisms to maximize collection in these domains of economic activity. On the other hand, some countries consider that lowering taxes on the digital sector of the economy triggers spillovers that are larger than the foregone taxes. This effect in the case of broadband taxes is depicted in the following Figure A.

Figure A: Virtuous circle of tax reduction on broadband devices, equipment and services



Source: Katz, R. and Berry, T. (2014) Driving Demand of Broadband Networks and Services. London: Springer

As Figure A indicates, a reduction of taxes on devices and service has a positive impact on broadband penetration as a result of demand elasticities. The increase in broadband penetration improves the number of households connected (in fixed broadband) and the number of mobile broadband subscribers per infrastructure deployed. This increase in penetration enhances the return on the network capital invested. A higher return on capital allows the broadband service provider to lower prices, which in turn has a positive impact on penetration. At the same time, an increase in broadband penetration has direct and indirect effects. On the direct side, it means an improvement in the revenues of broadband operators. On the indirect side, it enhances the contribution of broadband to economic growth and employment. Both effects increase the taxable base, which in turn grows the collected taxes beyond the amount foregone by reducing taxes on broadband devices and services. This effect yields higher welfare benefits.

In principle, taxation should attempt to be neutral and equitable across all sectors of the economy. A distortion occurs when a change in the price of a good resulting from taxation triggers different changes

in supply and demand from what would occur in the absence of taxes. Taxes can create distortions if they affect the choices made by market agents, which in the digital space could be the following:

- consumers, particularly those that are price sensitive, face an affordability barrier in the adoption of technology if taxes increase the total cost of ownership;
- telecommunications/ICT service providers reduce their rate of investment in infrastructure if taxes reduce the total available capital to be spent;
- global digital technology providers adapt their deployment footprint according to a minimization of tax burden; and
- different tax regimes within the digital eco-system create asymmetries across industrial sectors.

This study identifies the distortive effect of taxes in the digital eco-system on three levels:

1. Potential disparity in tax burdens imposed on telecommunication operators when compared to other operators of the digital eco-system (for example, digital advertisers, social networks).
2. Taxation asymmetry among global players in the digital sector.
3. In country taxation asymmetry between the telecommunication sector and other providers of other goods and services.

Governments should examine these asymmetries to determine whether they are a source of distortion. Furthermore, considering the significant indirect impact of digital platforms (such as new business creation, and transaction efficiencies), governments should examine the issue of taxation of digital players in a careful manner. In developing fiscal policies, governments need to consider the trade-offs between revenue generation and the potential negative impact on the development of the digital sector. Recognizing that answers to these questions should be developed based on country-specific policy trade-offs between revenue generation and the potential negative impact on the development of the digital sector as well as the telecommunication/ICT market environment, the evidence provided in this report should help understand the implications of these decisions.

The evidence regarding the economic impact of digital industries, ranging from fixed broadband to computing, the Internet, and mobile broadband, continues to grow. From that perspective, the argument to reduce potential distortions emerging from over-taxation of the sector is gaining ground. As others have argued, the reduction in digital sector taxes needs to be weighed in terms of the potential reduction in revenues. Having said that, the need to establish a balanced view of tax policy across sectors in order to eliminate distortions is a tall order.

Table of Contents

Executive Summary iii

1 Research on the impact of taxation on consumption and capital investment 3
- 1.1 Impact of taxation regimes on capital flows and gross fixed capital formation 4
- 1.2 Taxation and consumption of consumer goods 6
- 1.3 Taxation and public policy objectives 7

2 An overview of taxation on sectors of the digital eco-system 8
- 2.1 Taxes applied to Telecommunications operators 9
- 2.2 Taxes applied to the consumption of telecommunication services 9
- 2.3 Taxation of Internet service providers 13
- 2.4 Over-the-top (OTT) players taxation 15
- 2.5 Applications providers 20

3 A typology of taxation regimes in the digital sector 21
- 3.1 Taxation trends and fiscal policy in the digital economy 21
- 3.2 Regional and country differences 22
- 3.3 The impact of taxation on wireless adoption 26

4 Distortive taxation regimes in the digital economy 28
- 4.1 Dimensions of distortion 28
- 4.2 Double taxation for international telecommunication services 32
- 4.3 Taxation regimes of global players with no local presence 34
- 4.4 Tax optimization approaches 42

5 Issues regarding tax collection in the digital sector 42
- 5.1 Obstacles to effective tax collection 43
- 5.2 The case of evasion and fraud 43
- 5.3 Informal digital economy and grey markets 44

6 Economic impact of taxation on the performance of the digital economy 44
- 6.1 Impact of taxation on telecommunication capital investment 45
- 6.2 Impact on ICT adoption and overall digitization 46

7 Comparison of digital sector taxation with other sectors 51
- 7.1 Overview of taxation in other sectors of the economy 52
- 7.2 Conclusions of the comparison of digital sector taxation with other sectors 57

8 Lessons learned, best practices and fiscal policy recommendations 58
- 8.1 Addressing tax imbalances 59
- 8.2 Maximizing impact on digitization 60

Annex A: Models estimating the impact of taxation on telecommunication capital investment 63

Annex B: Taxes on PCs and tablets 67

List of tables, figures and boxes

Tables

Table 1: Examples of consumer taxes impacting total cost of ownership of mobile telecommunications (2014) 10
Table 2: Global annual revenues of OTT firms (in USD '000) (2013) 15
Table 3: Service taxation approaches by country (2014) 23
Table 4: Handset taxation approaches by country (2014) 24
Table 5: Overarching taxation approach by country (2014) 25
Table 6: Mobile taxation approaches in five countries with emerging market economies (2014) 28
Table 7: Effective tax rates for telecommunication and Internet players (2014) 29
Table 8: Netflix: Paying subscriber base ('000) (2Q2014) 35
Table 9: Facebook: Revenues and margin from advertising and transactions 36
Table 10: Facebook: Monthly users and revenues per user 36
Table 11: Facebook pro forma income statement (typical emerging market) (2014) 38
Table 12: Amazon: Diversification schedule 40
Table 13: Amazon revenues (USD millions) (4Q2013) 41
Table 14: Economic effects of eliminating the sales tax on network equipment 46
Table 15: Impact on weighted average penetration level of fixed broadband of a price reduction (2013) 48
Table 16: Penetration growth (per household) of fixed broadband as a consequence of a price reduction 49
Table 17: Specific additional duties and taxes on import of PCs and tablets 51
Table 18: Digital sector: US effective tax rate (2014) 53
Table 19: Tourism sector: US effective tax rate (2014) 54
Table 20: Media sector: US effective tax rate (2014) 54
Table 21: Digital sector: Europe effective tax rate (2014) 54
Table 22: Tourism Sector: Europe effective tax rate (2014) 55
Table 23: Media sector: Europe effective tax rate (2014) 55
Table 24: Digital sector: countries with emerging market economies effective tax rate (2014) 56
Table 25: Tourism sector: Countries with emerging market economies effective tax rate (2014) 56
Table 26: Media sector: Countries with emerging market economies effective tax rate (2014) 56
Table A1: Variables of sales taxes effect on investment 63
Table A2: Model of impact of sales tax rate on investment – OLS Model of impact of sales tax rate on investment with autoregressive factor (2006-2010) 64
Table B.1: Cumulative customs duty and sales taxes on personal computers (2014) 67
Table B.2: Cumulative customs duty and sales tax on tablets (2014) 68

Figures

Figure A: Virtuous circle of tax reduction on broadband devices, equipment and services iv
Figure 1: Value chain of the digital economy 1
Figure 2: Example of taxes at stages of the digital eco-system value chain 8
Figure 3: Impact of taxes on broadband network investment 14
Figure 4: Sales tax rate on telecom equipment and telecommunication capital spending (2006-2010) 14
Figure 5: Internet retail as a percentage of total retail (2013) 19
Figure 6: Combined taxation approaches (2014) 25

Figure 7: Tax burden and 3G penetration in selected European countries (2013) 27
Figure 8: Tax burden and 3G penetration in selected Latin America and Asia-Pacific countries (2013) 27
Figure 9: Facebook: Flow of funds and tax implications 37
Figure 10: Amazon: Diversification strategy 40
Figure 11: Correlation between fixed broadband penetration and price elasticity 47
Figure 12: Emerging countries: Effective tax rate by industry (2014) 57

Boxes

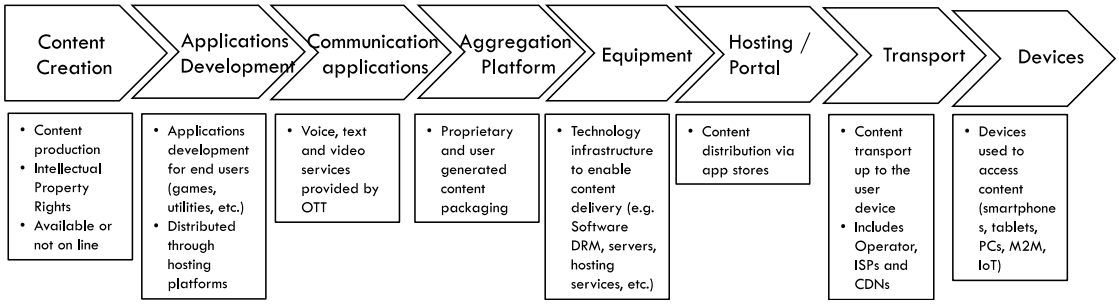
Box 1. Taxes on wireless telecommunications in the United States 11
Box 2. Tax burden on wireless industry in the United States 31

Introduction

Decisions regarding taxation are driven by public policies guided by normative goals (how much revenue should the state collect to pay for what type of services to be provided to its citizens?) and the cost/ benefit equation incurred to meet those objectives. While the benefits of taxes relate to general policies (e.g. raising revenues to support the public administration) or specific objectives (e.g., support the development of broadband in schools), economic theory also shows that, in general terms, taxation affects market equilibrium by shifting the demand and supply curves as a result of raising prices with the consequent reduction in the quantity of goods. Along these lines, the impact of taxation in the digital economy is a multi-pronged debate that needs to be structured around not only the benefits it generates, but also the costs in lost surplus it may imply.

In the case of the digital economy, the debate around taxation entails multiple issues. Let's start by assuming that the concept of digital economy encompasses all firms involved in the generation, processing, consuming, storing, and transferring digital goods and services. In general terms, the digital eco-system involves all firms operating in the following value chain (see Figure 1).

Figure 1: Value chain of the digital economy



Source: ITU

The digital economy value chain comprises firms operating within an eco-system delivering content and applications to consumers and enterprises. The first three stages are focused in developing raw content, providing applications such as games and other platforms, and offering communications utilities. In the far left of the chain, content creation firms assume responsibility for developing news, video, music, etc. In the next step, a number of players develop applications and services, such as games (e.g. Zynga), electronic commerce (e.g. eBay), and other utilities. In the next stage, the developers of communications applications operate messaging (e.g. WhatsApp, Viber), and VoIP (e.g. Skype) platforms. The aggregation platforms, located in the fourth stage, are either social networks (e.g. Facebook, LinkedIn) or search utilities (e.g. Google, Bing) that are a point of access to content, utilities and communications applications operating in the first three stages. The equipment stage comprises firms providing technology inputs to service providers, while the hosting stage of the value chain comprises a range of infrastructure companies supporting the ecosystem: data centre operators, hosting services (e.g. IBM, Amazon Web Services), and companies that offer back-office services (such as authentication, billing, marketing, and analytics). The transport stage comprises traditional telecommunication operators providing connectivity, while the device suppliers are the manufacturers of smartphones, PCs, tablets, and associated software.

In theory, it could be assumed that each stage of the value chain should be taxed according to standard and uniform fiscal policy principles. However, since a lot of the firms operating within this eco-system do so on the basis of new business models (with little infrastructure, no presence in countries where the service is purchased, or delivering intangible products) the principles of taxation do not seem to be clearly defined. In fact, several policy decisions regarding taxation in this sector of the economy are currently being widely debated:

- **What is the appropriate level of taxation imposed on capital equipment purchased by telecommunication operators?** In many countries around the world, broadband and mobile

service operators pay sales taxes and import duties on the acquisition of network equipment. In some cases, the argument justifying taxes is focused on protecting local technology industries. However, certain governments (e.g. Malaysia, some states in the United States of America) have decided to exempt carriers from paying sales tax on equipment. The argument in this case is that, by collecting taxes, the rate of deployment of broadband networks might be negatively affected. If this is the case, the spillover benefits of broadband might be limited.

- **How should Internet sales be taxed?** Consumers pay sales taxes at the time of purchasing of a good based on the location of the physical store at which the consumption is conducted. However, governments find it difficult to tax Internet sales because there is no retail address. In theory, the consumer is required to pay the tax to the government authority where he resides. Some countries, such as Switzerland, have been successful at implementing this. However, this is not always the case. While the volume of e-commerce as a proportion of retail trade continues to increase around the world, sales taxes on goods purchased on the Internet are not paid in many cases. Some governments are trying to redress this imbalance by taxing e-commerce sales.
- **How should consumption of digital goods be taxed?** The issue raised in the point above could be extended to the purchasing of digital goods (such as the payment of a monthly fee for video streaming services). In most cases, payment of video streaming subscriptions from providers like Netflix or Apple TV does not include taxes. In a recent case, the municipal government of Buenos Aires, Argentina imposed a tax on Netflix subscriptions to be collected on the basis of monitoring of relevant credit card transactions. The purpose of the tax was to protect local providers of competing services.
- **Should the consumer purchasing wireless devices (smartphones, and tablets) and personal computers be taxed?** In most countries of the world, consumers pay a wide range of taxes at the time of acquisition of digital equipment (in most cases, they include a sales tax and import duties, but they might also include sector specific taxes). Some countries have imposed unusually high import duties and sales tax with the purpose of protecting national assembly sectors or collecting revenues. For example, Argentina collects a 35 per cent import duty and 21 per cent sales tax on imported mobile phones. Brazil imposes a 19 per cent duty and a whole range of additional taxes that could reach up to a 40 per cent rate. Venezuela collects an import duty of 14 per cent and imposes 12 per cent in sales tax. On the other hand, other countries, such as Colombia, assuming that taxes increase the cost of acquiring service, thereby reducing ICT adoption, have decided to exempt digital devices from import duties and even sales taxes for underprivileged citizens.
- **Should the providers of digital platforms such as Google and Facebook be taxed at the country where revenues are generated, or should they benefit from international rules that allow them to take significant corporate tax exemptions?** Some governments argue that, to avoid distortions and asymmetries, these operators should pay taxes at all locations where digital advertising in their platforms is fulfilled. Others are reluctant to impose levies given these operators' significant indirect economic contributions (e.g. new business creation, efficient market signalling and distribution).
- **Should Internet service providers pay taxes the same way as telecommunication carriers?** Examples around the world provide a sense of how complex this issue is. For example, the recent debate over net neutrality in the United States hit a taxation snag. Since 2002, the Federal Communications Commission voted to classify cable modem service as an "information service", falling under Title I of the Communications Act. At the time, the explanation was that less regulation would "promote investment and innovation", which would yield "better quality, lower prices, and more choices for consumers". In 2015, however, the FCC "reclassified" Internet service providers as common carriers under Title II of the Communications Act of 1934. In this context, the FCC requires all telecommunication carriers to contribute 16.1 per cent of interstate telecommunication revenues to the Universal Service Fund (USF). Additionally, by reclassifying ISPs under Title II, broadband access could be potentially affected by multiple taxes and fees commonly imposed on telecommunication carriers by state and local governments. In practice, reclassification would

mean consumers would pay more for broadband, potentially triggering disconnects and raising economic barriers for disadvantaged consumers. While the issue is not completely settled, the move raises the question of appropriate compromise between network neutrality and increased taxation. One approach would be that, in light of the economic effects mentioned above, network neutrality regulation should be tackled without including its taxation dimensions.

In another highly publicized case, the government of Hungary tried in 2014 to impose a tax on ISPs, requiring them to pay 150 forints (EUR 0.49) for every gigabyte of data traffic over their network. While the Hungarian government stipulated that it would make sure that the tax was not passed along to consumers, the measure faced harsh criticism. In the end, after large-scale protests, the tax plan was dropped1. Taxation of ISPs could also be applied in an indirect fashion. For example, in Ghana ISPs pay taxes on access modems to be installed in consumers' premises. In this case, this levy is passed on to consumers, which increases the cost of acquiring broadband service2.

The question raised by these examples is whether a broadband tax is likely to stifle innovation and limit adoption of what is recognized as a general-purpose technology that contains important economic spillovers.

The list of issues could be extended, but the cases mentioned above serve to raise the point that taxation in the digital economy is one of the most important policy issues of the day. Furthermore, as indicated above, none of the cases have easy answers, since they entail normative objectives and have to be assessed with the help of rigorous cost/ benefit analysis.

This study attempts to shed some light on the state of the debate. Rather than taking a position on each of the issues, its purpose is to explain the theory and provide some of the evidence behind the choices governments need to make on the issue of taxation in the digital sector. These choices will certainly affect the evolution of the digital ecosystem in the years to come.

The paper begins by presenting in Chapter 1 the evidence and principles defined so far regarding the impact of taxation on consumption and capital investment. Chapter 2 presents an overview of taxation approaches on sub-sectors of the digital eco-system. Chapter 3 provides a perspective of how different countries approach the definition of taxation regimes in the digital economy. Chapter 4 raises the issue of distortion in digital sector taxation. Chapter 5 deals with potential barriers facing governments attempting to collect taxes in the digital world. Chapter 6 provides evidence of how taxation regimes might have a positive or negative economic impact. Chapter 7 presents cases where taxation regimes in the digital eco-system may contribute to generate distortions. Chapter 8 wraps up the analysis, highlighting some practices and recommendations.

1 Research on the impact of taxation on consumption and capital investment

The most important function of taxes is to raise revenue to finance government activities, ensure delivery of public goods, such as education, health, security, and deploy public infrastructure. In principle, governments maximize benefits to society only if they choose to tax when the marginal benefit of the services provided with the revenue derived from taxation exceeds the cost of the tax in terms of economic surplus. Taxes are typically raised on both net income and consumption of goods and services. The first type is collected over income generated in a fiscal year, while the second one is linked to the acquisition of a good or service (for example retail sales tax, value-added tax, and

[1] Fiscutean, A. (2014). "Plan to tax Internet traffic in Hungary sees protesters take to the streets". *Central European Processing*; "Hungary's Government Walks back Internet tax schemes after protests". *Latin American Herald Tribune*, March 2, 2015.

[2] "ISPs push for tax waivers on modems". *Business News (Ghana),* May 8, 2013.

import duties)3. In a specific case of income taxes, the corporate income tax is assessed either from the firm's income statement (profits after expenses) or the value of the net assets in the balance sheet. This section presents research on the impact that taxation can have on a corporation's capital flow and gross fixed capital formation, as well as on individual consumption.

1.1 Impact of taxation regimes on capital flows and gross fixed capital formation

The research literature tends to concur that a rise in the corporate tax rate in an open economy causes a net capital outflow, and negative economic welfare. Since taxes tend to raise the required pre-tax rate of return of capital invested, the aggregate capital stock in a given economy depends on the effective tax rate4.

In general terms, most research literature has found that taxation regimes play an important role in driving capital flows, when controlling for economic development, unemployment and currency fluctuations5. Accordingly, when a firm has to make an investment decision, taxation plays a significant role. Taxes affect both the incentives of a company to make investments and reduce the supply of funds available to finance them. Several empirical studies indicate that, all things being equal, marginal and average tax rates have a negative effect on investment decisions. It should be noted here before going further that this research evidence has been generated in a pre-digital age context. Given the "intangible nature" of digital goods and the structure of digital firms' business models, one could argue that the influence of taxation on capital flows and firm behaviour might not be the same as in the case of physical goods (or at least, that the dynamics might be slightly different). The topic will be addressed further in this document.

Since investment is one of the engines of long-term economic growth, taxation plays a direct role in this equation. Research has shown that a reduction of corporate income taxation determines, over time, an increase in the level of gross fixed capital formation6. Research has also found this effect to be more important in emerging market economies, where investment needs are greater.

However, taxes are just one of the many factors driving capital investment decisions. Beatty et al. (1997) showed that high net equity financing activity (access to low cost funds) and high stock returns (market signalling) are also important variables in explaining high future net capital expenditures7. Similarly, as expected, the authors found that high net income and low dividend pay-outs are important predictors. Nevertheless, when controlling for these factors, the authors also found that, for instance, changes in the tax code in the United States in 1986 had a real effect on the investment behaviour of US-based firms8.

---

3 See OECD. *Addressing the tax challenges of the Digital Economy.* Paris, 2014.

4 As Devereux, M.P. states, "(If a) company should invest up to the point at which the marginal product of capital equals the cost of capital (...) the impact of taxation should be measured by the influence of (an effective marginal tax rate) on the cost of capital". (*The impact of taxation on the location of capital, firms and profit: a survey of empirical evidence.* Oxford University Centre of Business Taxation. Working paper WP 07/02, 2006).

5 See Slemrod, J. "Tax effects on Foreign Direct Investment in the United States: evidence from a cross-country comparison", in A. Razin and J. Slemrod eds. *Taxation in the Global Economy*, Chicago: University of Chicago Press, 1990, pp. 79-117.; Devereux, M. and Freeman, H. "The impact of tax on foreign direct investment: empirical evidence and the implications for tax integration schemes" *International Tax and Public Finance,* 2, 1995, 85-106.; Jun, 1994. *How taxation affects foreign direct investment (country-specific evidence),* Policy Research Working Paper 1307, Washington DC: World Bank.; Billington, N. "The location of foreign direct investment: an empirical analysis", *Applied Economics,* 31, 1999, 65-76.

6 Talpos, I. and Vancu, I. (2009). "Corporate Income Taxation Effects on Investment Decisions in the European Union", *Annales Universitatis Apulensis Series Oeconomica*, 11 (1), pp. 513-518.

7 Beatty, R., Riffe, S., Welch, I. (1997). "How Firms make capital expenditures decisions: financial signals, internal cash flows, income taxes and the Tax Reform Act of 1986". *Review of Quantitative Finance and Accounting*, 9 (1997): 227-250.

8 In 1986, the U.S. Congress passed the Tax Reform Act (TRA) to simplify the income tax code, broaden the tax base and eliminate many tax shelters and other preferences. The act raised overall revenue by USD 54.9 billion in the first fiscal year after enactment. As of 2014, the Tax Reform Act of 1986 was the most recent major simplification of the tax code, drastically reducing the number of deductions and the number of tax brackets (for the individual income tax) to three.

The mechanisms by which taxes affect technology (particularly telecommunications) investment are fairly complex. In general terms, Devereux (2006) considers that taxation first affects two binary decisions: in **which business** to invest (e.g. wireless, broadband, or other) and, in **which geographic location** to invest (e.g. a specific country)9. In addition, taxes also influence a continuous choice: once a business and locations are agreed upon based on taxation attractiveness, levies affect their capital expenditure allocation process. In other words, taxes will influence **how much** investment will favour certain locations to the detriment of others.

It should be noted that changes in tax regimes do not affect investment decisions instantaneously. Investment decisions are partially driven by variables that only change gradually (e.g. changes in the cost of capital). As a result, a modification of taxation regimes (e.g. a change in the sales tax rate affecting the initial purchasing of network equipment) might affect the incentives to invest immediately, but translate in investment decisions only gradually10. An implication of the evidence that indicates that corporate investment behaviour lags changes in tax regimes is that countries that constantly change tax policies introduce another layer of complexity for firms planning future investment. In other words, by the time the firm is ready to adjust to the tax regime imposed in past years, a new change imposed by the government modifies the underlying premise of future investment. This situation, which is rather common in the telecommunication industry, makes it very complex for operators to plan future capital investments.

The factors outlined above are even more important in capital-intensive industries such as telecommunications. Typical capital planning processes in telecommunications comprise decisions in three domains: maintenance of existing plant (e.g. replacement of depreciated equipment), network modernization (e.g. deployment of 4G networks, deployment of fibre in the access network, deployment of DOCSIS 3.0), and capacity upgrades (e.g. investment to accommodate growth in demand). Each investment domain is driven by different time constraints. For example, maintenance capital investment is typically multi-year and mostly non-discretionary; therefore, it is largely predictable and relatively less subject to taxation effects. Network modernization capital, while also being multi-year, could be affected by capital allocation decisions influenced by taxation (in other words, if taxation reduces the supply of funds, it could impact investment thereby affecting the rate of network modernization). On the other hand, capacity upgrades have a long-term component driven by demand forecast, but also a very short-term component focused on surgical infrastructure upgrades (e.g. accommodate spikes in demand in certain portions of the network). This area of capital investment might be less affected by taxation regimes since it is directly linked to revenue generation opportunities.

Again, this last finding does not necessarily apply to digital players, such as Google or Facebook, which are less burdened by capital investments than conventional telecommunication operators. First, digital firms such as social networks or digital advertisers have limited infrastructure needs when compared to a network operator. Second, technology needs of digital firms are highly scalable ("pay as you go"), which limits the risk of stranded capital. Third, rather than requiring deployment over multiple countries like it is the case of telecommunication service providers, the resource conditions of digital operators allow them to centralize their infrastructure, thereby limiting the exposure to different tax regimes. All these differences indicate that digital operators behave in a different way when it comes to taxation, since they have much more flexibility to devise tax strategies.

The impact of taxation on corporate behaviour tends to vary according to the economic cycle, and evidence exists that in periods of economic expansion, the negative impact of taxation on investment affects primarily the supply of funds and not the incentives to invest11. Lintner states that, "So long

---

9 Devereux, M (2006). The impact of taxation on the location of capital, firms and profit: a survey of empirical evidence. Oxford University Centre of Business Taxation. Working paper WP 07/02.

10 See (Auerbach, 2005).). *Taxation and capital spending*. Paper prepared for the Academic Consultants Meeting of the Board of Governors of the Federal Reserve System. University of California and NBER, September 2005.

11 Lintner, J. (1954), *Corporate Income Taxes: Their Effect on Investment*. Proceedings of the Academy of Political Science, Vol. 25, No. 4, The American Economy, Keystone of World Prosperity (Jan., 1954), pp. 14-26.

as profit positions are not unacceptably low and the necessary funds are available, very substantial amounts of new investment will be undertaken even where there is no very clear enough evidence that the individual investment moves will add enough to net profit to make them worthwhile".

The incentives mentioned include maintaining or improving a company competitive position, or increasing market share. Conversely, in periods of economic downturn, the effects of taxes on investment incentives would be relatively more important, and the availability of funds becomes less important in influencing investment decisions12.

1.2 Taxation and consumption of consumer goods

Consumers are taxed based on their acquisition of goods and services. Taxes on consumption are important because they can affect the behaviour of users with regards to purchasing and use of digital goods and telecommunication services. The most prominent tax paid by consumers in some countries is sales taxes. As mentioned above, sales taxes are paid by retailers on the basis of the price of the good being sold. Although stores could simply incorporate the tax into the price of their goods, most stores add the tax onto the bill after the initial sale is calculated, to make the consumer aware of it. Because the burden of the sales tax depends on the price elasticity of the good, consumers will tend to assume the burden if demand is inelastic (in other words, if they cannot change their behaviour if a sales tax is imposed). Alternatively, if consumers shift their behaviour as a result of the tax (for example, stop purchasing the good once the tax is assessed because it is unaffordable by their budget), the burden of taxation is born by the supplier. In fact, while there are goods for which demand is inelastic (e.g. cigarettes) or completely elastic (e.g. luxury cars), the burden of taxation is, in most cases, shared between suppliers and consumers based on the relative elasticities of supply and demand.

The elasticity of telecommunication services is a function of penetration. At low levels of adoption, demand is fairly elastic, while elasticity diminishes over time. By compiling evidence of broadband service elasticity over time in the United States, it has been shown that, with growing penetration, elasticity coefficients tend to diminish significantly13. The same effect would apply to mobile telephony. Under inelastic conditions of telecommunications at high levels of penetration, consumers are expected to bear most of the taxation burden. This topic will be addressed in detail in section 6.2.

Beyond sales taxes, value-added taxes (VAT) and other consumption taxes are also designed to be indirect taxes because they are collected from the suppliers rather than consumers. The VAT is the primary form of consumption tax for most countries around the world. While similar to the sales tax in that it is imposed on consumption, but contrary to single-stage levy imposed on the final consumer, this tax is collected through a staged-process, whereby each entity in the value chain is responsible for collecting the tax on its output.

The third category of consumption tax comprises levies on specific goods and services, consisting primarily of excise taxes, customs and import duties, and taxes on specific services (e.g. tax on purchase of mobile handsets).

Research on consumer response to taxation varies according to the policy being considered. For example, under a tax reduction policy, consumers are expected to increase consumption. However, research has found that they will increase spending if the reduction in tax liabilities becomes permanent. In addition, consumers will wait to increase spending until a tax reduction affects their take-home pay, not before14. On the other hand, an increase in taxes, even a small change, has an impact on consumer behaviour, by eliciting a reduction in consumption. This has been shown to be

---

12 See also Fazzari, S; Hubbard, G; and Petersen, B. (1988). "Financing constraints and corporate investment", *Brookings papers on economic activity*.

13 Katz, R. and Berry, T. (2014). *Driving demand of Broadband Networks and Services*. London: Springer., p. 141.

14 See Steindel, C. (2001). "The effect of tax changes on consumer spending", *Federal Reserve Bank of New York. Current Issues in Economics and Finance*, volume 7, number 11.

the case in fuel taxes15, and would also be the case for telecommunication services. The popular reaction against an Internet tax in Hungary cited above would prove this point. In a recent study, it was also found that the imposition of a sales tax on products purchased on line in the United States (called the "Amazon tax") had an impact on consumer behaviour: consumers that face a tax on Amazon purchases tend to partly shift back to local "brick and mortar" retailers, or increase purchasing from competing non-taxed online retailers16. This particular finding will be discussed in detail in section 6.3.

1.3 Taxation and public policy objectives

As mentioned above, the primary policy goal of taxation is to provide a fair, efficient, and predictable way of financing government expenditures and delivery of public services. However, taxes can also be implemented to protect domestic industries, raise funds for specific public objectives (e.g. address the digital divide) and the like. To achieve these multiple objectives, governments select a mix of taxes. The mix of taxes varies across countries and even sub-sovereign entities (states, cities, etc.) because of the different objectives governments are attempting to maximize. Broadly speaking, a tax structure comprises income, sales, corporate, capital gains, property, inheritance, wealth (or net worth), and sector specific (such as insurance, energy, etc.). In this section, a brief description is provided of the general characteristics of taxes that have an impact on the dynamics of the digital eco-system.

1.3.1 Sales taxes (national, state and local)

Sales taxes are collected when a good or service is sold to its final consumer. The amount of the tax varies although it is usually based on a percentage of the sale amount. Sales taxes are typically collected at the national, state, and local level. Since there can be several jurisdictions charging a sales tax, the retailer must add the amount of tax for each of them to calculate the Combined Sales Tax Rate. In the case of Internet sales, the rate used is that of the location where the consumer resides.

Other taxes that are similar to the sales tax are the excise tax (charged on goods or sales produced within the country), and the gross receipt tax (charged on the gross revenues of a business or company). The fundamental difference in these cases is that both of them are charged to the firm producing the good (such as a telecommunication operator) rather than the consumer, although the operators transfer them to consumers if taxes are part of their cost of capital.

From a policy standpoint, sales taxes are considered as an alternate way for collecting revenue, as many governments rely primarily on this approach to avoid income taxes. In addition to the general sales tax rate, governments can enact taxes that affect the sale of specific goods and services (e.g. beer, wine, tobacco, luxury cars). In this case, the objective is to discourage consumption, in addition to raising revenue. Conversely, sales taxes can be exempted in case of ordinary clothing and food to give low income segments a slight advantage. This has also been the case in telecommunication services. For example, Colombia has exempted the three lowest social strata from paying value added taxes on broadband services. This results in a 16 per cent reduction in subscription tariffs for these customers17.

1.3.2 Import duties

Custom duties are put in place as a measure to limit imports in order to protect nascent industries until they develop comparative advantage, protect declining industries in order to slow down their rate of decline, protect strategic industries (such as energy, steel, armaments, and food), protect non-renewable resources, and deter unfair competition (such as dumping by foreign firms). Custom

---

15 See Fowler, J. and Li, S. and Muehlegger, E. (2011). Gasoline taxes and consumer behavior", John F. Kennedy School of Government, Harvard University.

16 See Baugh, B., Ben-David, I., and Park, H. (2014). "The "Amazon tax": Empirical evidence from Amazon and Main Street retailers", *National Bureau of Economic Research NBER Working paper No. 20052*.

17 Katz, R. and Callorda, F. (2015). *Experiencia de planes subsidiados o con tarifas sociales*. Study commissioned by the Government of Ecuador. Ministry of Information Society and Telecommunications. New York.

duties are imposed usually in an *ad valorem* form, as a percentage increase on the price of the imported product.

In general terms, an import duty results in a rising price for the consumer, with the consequent loss of consumer surplus. On the other hand, the loss in consumer surplus would have to be assessed in light of a gain in producer surplus resulting from price protection of domestic producers, and the consequent protection of local employment. Research, however, indicates that the reduction of consumer surplus resulting from custom duties is greater than the increase in producer surplus. This issue will be revisited in the context of digital products and services since additional negative effects of custom duties in this domain could range from a reduction in service adoption (as a result of higher prices), and a slowdown in the country's rate of technological innovation.

1.3.3 Sector specific taxes

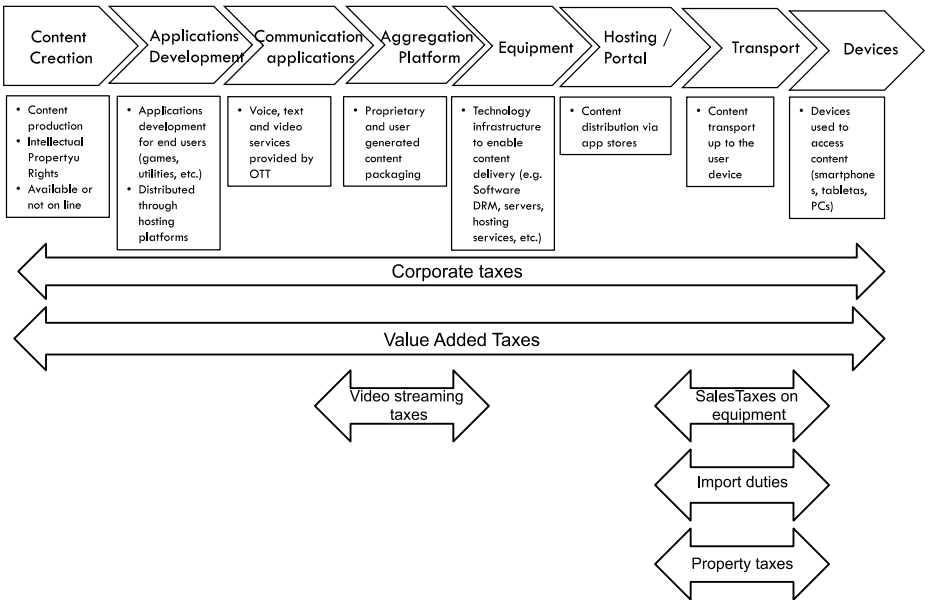
Sector-specific taxes are generally imposed on profitable sectors to raise funds for specific purposes (e.g. improve health care public service). These taxes are advantageous in terms of their predictability, sustainability, and low transaction costs. On the other hand, by raising the consumption costs, they tend to penalize the lower-income consumers, and they can be politically unpopular. From an institutional standpoint, it is often the point where sector-specific taxes are difficult to "ring-fence" in order to address the specific purpose for which they were collected, and they end up being used for other government priorities.

Having provided a review of the evidence regarding the general impact of taxation on the behaviour of firms and consumers as well as the different types of taxes, the next chapter presents how these are imposed in the case of the digital eco-system.

2 An overview of taxation on sectors of the digital eco-system

The digital eco-system is taxed by multiple levies at all stages of its value chain (see examples in figure 2).

Figure 2: Example of taxes at stages of the digital eco-system value chain



Source: ITU

As Figure 2 shows, corporate taxes and VAT are typically applied to all firms in the digital value chain. Import duties are included in all types of equipment, whether they are consumer-oriented or needed by infrastructure operators. Finally, firms within the eco-system can also be taxed through a number of sector-specific taxes, whether they are applied to the selling of digital goods (like video-streamed movies) or the ownership of wireless devices.

The following chapter will review the taxes imposed within five stages of the value chain:

- telecommunication operators;
- telecommunication consumers (including wireless and broadband users);
- Internet service providers;
- over-the-top players (comprising content providers, digital advertisers, and e-commerce players); and
- application developers.

2.1 Taxes applied to Telecommunications operators

Telecommunications operators typically pay corporate taxes on profits, but are also expected to contribute at several levels. First, in many countries operators pay import duties on equipment purchased from overseas suppliers. Second, service providers pay property taxes on buildings and land owned where equipment is installed. Third, telecommunication operators also pay sales taxes on equipment purchased. Sales taxes can be collected at three levels: national, state or province, and local. Finally, operators pay also taxes on local and international interconnection revenues.

In the first three cases - import duties on purchased equipment, property taxes, and sales tax on equipment- the burden of taxation is borne by the operator. In the fourth case, the burden is shared between providers and final users. As discussed in the general section, and will be further explained in section 6.1, the impact of these taxes is that they can potentially reduce the availability of investment funds18. Since, as mentioned above, taxes raise the required pre-tax rate of return of capital invested, aggregate capital stock depends on the effective tax rate. This can act as a disincentive to invest in network modernization and prompt carriers to continue operating with obsolete or capacity-constrained equipment, ultimately affecting consumer welfare, and telecommunication socio-economic contribution.

This last factor is the reason why some governments have made the decision to reduce equipment purchase taxes in order to stimulate the deployment of more advanced technologies. For example, of the fifty states in the United States, twenty exempt sales taxes on the purchasing of equipment by broadband providers. As in the case of Malaysia, the purpose is to treat broadband provisioning as a critical contributor to economic growth. In addition, research indicates that the spillover effects of deployed broadband amply compensate the foregone telecommunication tax by expanding the tax base.

Telecommunication operators are also imposed a tax payment on interconnection revenues, where double taxation raises the prices of telecommunication services, diminishing demand and additionally affecting tax revenues. This topic will be addressed below in section 4.2.

2.2 Taxes applied to the consumption of telecommunication services

Consumption in the telecommunication industry is affected by several types of taxes. As mentioned above, some taxes are directly borne by the consumer (e.g. fees attached to the acquisition of devices), while others, such as sales tax on services, while included in the subscriber bill, are shared by providers

[18] It is important to note, however, that, as mentioned above, taxation is only one of many variables affecting telecommunication investment.

and consumers. This section reviews taxes on wireless services (including mobile broadband), and fixed broadband.

2.2.1 Wireless users

In most countries, wireless users pay taxes at the time of service acquisition (generally linked to handset activation) and on an ongoing basis (linked to service delivery). Three types of taxes exist in the wireless services sector:

1. Value added or sales tax: most countries impose some form of value-added tax, a general sales tax or similar consumption tax as a per cent of the total monthly bill.
2. Telecom specific taxes: some countries charge an additional special communications tax as a per cent of the service bill.
3. Fixed taxes: in addition to the tax as a percentage of usage, some countries charge a fixed tax that could be either driven by general communications or wireless usage.

In addition to service-based taxes, other levies can be imposed on handsets (related to activation):

- Value-added or sales tax: these represent the taxes paid directly by the consumer at time of purchasing a subscription or handset, as well as when exchanging the device.
- Customs duty: this tax is already included in the retail price of the handset.
- Other taxes: telecommunication specific taxes on handsets (e.g. royalties calculated on the cost of handset).
- Fixed taxes**:** special fixed duties on handset, such as ownership fees and fees for recycling19.

In more detail, taxes on consumption of wireless include some or all of the following (see Table 1).

Table 1: Examples of consumer taxes impacting total cost of ownership of mobile telecommunications (2014)

	Initial purchase (taxes on devices)	Ongoing use (taxes on service)
GENERAL TAXES	• Sales tax on handset (United States) • Customs duty imposed on device (Argentina, Brazil, Pakistan, Panama, Peru, Tanzania) • Ownership fees • Excise tax (Argentina) • Special consumption tax on discretionary spending (Panama)	• Excise tax on usage (charged on calls, SMS, monbile broadband or m-Money) (Argentina) • Federal and provincial sales tax on service (Brazil, Pakistan, United States)
SECTOR SPECIFIC TAXES	• SIM card tax (Argentina, Bangladesh, Brazil, Chad, Egypt, Pakistan, Peru, Turkey) • Activation VAT (Tanzania)	• *Impuesto especial sobre producción y servicios (Mexico)*

Source: ITU

[19] In Switzerland for example, 1 CHF is added to the price of all electronic appliances as an anticipated recycling fee.

Some of these taxes are specific to some countries20. For example, box 1 describes the taxes imposed on the wireless sector in the United States.

Box 1. Taxes on wireless telecommunications in the United States

Wireless operators in the United States are subject to them following taxes and contributions:

- Federal USF tax: The programme subsidizes telecommunications services for schools, libraries, hospitals, and rural telephone companies operating in high cost areas. The USF is assessed on a provider's interstate revenues, which the FCC deems to be 37.1 per cent of the wireless bill for customers purchasing calling plans that do not distinguish between interstate and intrastate calls.
- Most states in the US impose 911 fees to fund capital expenses for the emergency system, and in some cases, the fees fund 911 operations as well.
- State USF funds: some states have their own USF that provide subsidies for many of the same purposes as the federal USF. State USF surcharges are imposed on revenues from intrastate telecommunication services, while the federal USF applies to revenues from interstate services.
- State-level gross receipt wireless taxes: In addition to 911 fees and state USF charges, a total of 13 states impose taxes on wireless service at the state level that are considered either in addition to sales taxes or in lieu of sales taxes but at a higher rate than the state sales tax.
- Local taxes: Local governments in 12 states currently impose some type of local tax or fee on wireless consumers. With the exception of California, which does not impose a sales tax on wireless service, these local taxes are in addition to any applicable state-level tax on wireless service.

According to this list of taxes, US consumers pay an average of 17.05 per cent in combined federal, state, and local tax and fees on wireless service. This is comprised of a 5.82 per cent federal rate and an average 11.23 per cent state-local tax rate. Because of the decentralization of tax policy, the tax rate can reach 18.6 per cent (Washington State) or Nebraska (18.48 per cent). In addition, due to local nature of some taxes and fees, four cities – Baltimore, Chicago, New York City, and Omaha – have effective tax rates in excess of 25 per cent of the customer bill. In sum, the average rates of taxes and fees on wireless telephone services are more than two times higher than the average sales tax rates that apply to most other taxable goods and services (Mackey and Henchman, 2014).

The Universal Service can also be considered a contribution insofar that its purpose is to address a specific market failure with a social policy. See comments below.

In Brazil21, the mobile taxation system is fairly complex. A calculation shows that of every Brazil Real that a consumer pays for telecommunication services, about 0.65 goes to the government. The basic tax structure comprises an internal VAT (ICMS) that is calculated over revenues and is set by each state in Brazil. It ranges from 18 per cent to 35 per cent, and thus, is equivalent to 22 per cent to 54 per cent of an internationally understood VAT. Additionally, there are two other contributions: PIS and Cofins, at the rates of 0.65 per cent and 3 per cent, a universal service contribution (1%) and a contribution to pay for Anatel (regulator) running costs (0.5%). There is also an additional per subscriber (initial tax) charge of about BRL 25 in mobile telephony. Most of these taxes also apply to handsets, though

[20] See chapter 3 on detailed review of taxes applied in each country.

[21] Katz, R., Flores-Roux, E., and Mariscal, J. (2011). The impact of taxation on the development of the mobile broadband sector. London: GSMA. Deloitte (2012). Mobile telephony and taxation in Latin America. London: GSMA.

certain types of handsets are also subject to import duties. Except the VAT and the universal service contribution, all of these taxes work in "cascade mode", meaning they are paid on every transaction (this is relevant on interconnection payments). In sum, the total tax on the Brazilian consumer total cost of ownership of a wireless phone is estimated at 43.3 per cent. Services are taxed at 40.2 per cent and handsets at an average of 57.3 per cent, assuming 30 per cent of handsets are imported22.

In a recent case, the government of El Salvador has introduced a bill proposing a 10 per cent tax on telecommunication services, with the intention of raising funds for implementing El Salvador's insurance plan23.

An issue worth mentioning here in terms of contributions borne by the wireless consumer is the universal service obligation. In principle, this amount, which is typically included in the subscriber bill, should not be considered a tax. If taxes are considered as revenues to the general treasury of a country to cover government needs, the universal service fund is effectively a contribution used for purposes of addressing the telecommunication supply gap (e.g. service provision in remote and isolated areas). On the other hand, in many countries, fund revenues are not distributed in terms of service deployment in unserved areas but tend to support government needs (for example, it is considered part of the budget of the Ministry of Communications). Along those lines, the difference between a conventional sales tax and a universal service fund contribution becomes less clear. Finally, regardless from the purpose of the monies collected, the burden of the universal service fund needs to be borne by either suppliers or consumers. With wireless telephony becoming less elastic as a result of growing penetration, it would be correct from an economic standpoint to consider the universal fund contribution to be a type of tax. Countries and market players tend to differ with respect to this issue. For example, in the United States, the universal service fund is considered a tax.

2.2.2 Broadband users

Broadband consumption taxes, generally referred to as Internet access taxes, are not uniformly applied across countries. They take the form of taxation on Internet service providers, which in turn levy these charges on consumers. In some cases, since broadband is considered to be a critical socio-economic need, regulators have chosen to exempt broadband service from any consumption tax. In other cases, governments consider the ever-growing Internet access an attractive source of revenue and therefore, subject to taxation.

All in all, attempts to introduce a tax on broadband usage has been met with considerable opposition from either advocates of network neutrality, or telecommunication/ICT operators, both concerned that an increase in taxes will raise the total cost of ownership of a broadband subscription, thereby limiting service adoption. For example, the issue was raised in France in 2008 when the opportunity of an Internet access tax was presented as a way to fund the country's state-owned television stations24. The tax was originally conceived as a way of helping suppress advertising on public channels by creating other sources of revenues. However, the proposal did not prosper.

In May 2013, the France Government considered the enactment of a 1 per cent "Internet tax" on smartphones and tablets25. Again, the objective was to help the development of French cultural content. After strong opposition of device manufacturers, the proposal was scrapped in September of 201326.

Similarly, the Government of Hungary proposed an Internet tax in October 2014. The levy was set at 150 forints (EUR 0.49, USD 0.62) per gigabyte of data traffic. While the tax would have been paid by ISPs, the government assured that it would prevent the tax to be transferred to consumers. The

---

22 According to the Association of Brazilian Electronics Manufacturers (ABINEE), Brazil exported 7.4 million smartphones and imported 7.5 million. Foxconn assembles the iPhone in a plant located in Brazil employing 6 000 workers and is planning to start sourcing components (cables, cameras, and touch-sensor screens in the country in 2016.

23 Telegeography. El Salvador government proposes a 10% tax on telecoms services. September 21, 2015.

24 "French President proposes Internet Tax", *Daily Tech*, January 11, 2008.

25 "France set to introduce 1% 'Internet Tax' on smartphones and tablets". *Daily Mail*, May 13, 2013.

26 "France postpones smartphone tax", *The Hollywood Reporter*, September 13, 2013.

government estimated tax revenues derived from the tax to reach 20 billion forints (or EUR 65 million). Hungarian consumers already have a tax on phone calls and text messages, but the maximum amount paid is capped. Individuals pay a maximum of 700 forints (EUR 2.27) a month, while companies have a 5 000 forint (EUR 16.26) limit. After mass protests, the government decided a month later to cap the tax at 700 forints (USD 2.90) per month for consumers27. In September of 2015, a 19.5 per cent tax on broadband usage was introduced in Pakistan28.

In the United States, as established by the Internet Tax Freedom Act (ITFA), the Federal government does not collect sales taxes on broadband subscriptions. However, as part of a compromise ten states are allowed to collect taxes on access charges higher than USD 25.00 per month.

2.3 Taxation of Internet service providers

Beyond taxes on Internet consumption, ISPs can also be subject to sector specific levies. These could appear in the form of conventional corporate taxes, sales taxes on initial equipment purchase, indirect taxes on equipment to be installed at customer premises, and property taxes for physical assets.

Corporate taxation of ISPs profits is fairly universal, although rates vary by country. For example, in Tanzania, the corporation tax affecting ISPs amounts to 30 per cent, while in Pakistan it is 34 per cent (with an additional 17 per cent on revenues)29. In Panama, the corporate tax rate on profits is 27.5 per cent30, while in Colombia it reaches 33 per cent. In this last case, if the company does not generate a profit, they are charged 3 per cent of equity value. Finally, in Argentina corporate taxes reach 35 per cent of profits.

In addition, taxation of ISPs could also be applied in an indirect fashion. For example, ISPs in Ghana pay taxes on access modems to be installed in consumers' premises. In this case, this levy is passed on to consumers, thereby increasing the cost of acquiring broadband service31. In this case, ISPs consider that, by raising the cost of service acquisition, collecting taxes on customer premise modem equipment raises the broadband adoption hurdle.

Sales tax on initial equipment purchase is another conventional way by which ISPs contribute to the treasury. As in the case of telecommunication operators, sales taxes are collected at either the national or federal, state or provincial, or local municipal level. Rates in this case could reach up to 10 per cent, to which customs duty on network equipment should be added. In Chile, for example, the customs duty is 6 per cent. In Mexico, the duty on imported network equipment varies by type of device, ranging between 5 per cent and 15 per cent32.

Another type of ISP taxation is that of property taxes. For example, in the United States these operators pay property taxes for the physical assets they own in each state, as well as sales tax on the equipment purchased to support the delivery of broadband service. Payment of property taxes is based on the notion that broadband providers are "utilities", and as such, they need to pay taxes originally established for railroads. The amount is calculated by valuing the entire business enterprise, rather than summing up the fair market value of specific fixed assets owned by the business33. The key ratio in determining the tax to be paid is the so-called "assessment ratio", which is the proportion of the property value that the tax rate is applied in establishing the amount to be paid in property taxes. In an example of sector discrimination, a number of states define higher assessment ratios to the

---

27 Source: Fiscutean, A. "Plan to tax Internet traffic in Hungary sees protesters take to the streets". *Central European Processing*. October 23, 2014.

28 BBC News. Broadband tax hits Pakistan Internet users. September 13, 2015.

29 Source: International Bureau of Fiscal Documentation; Pakistan Telecommunications Authority.

30 KPMG (2015). *Corporate tax rate tables.*

31 "ISPs push for tax waivers on modems". *Business News (Ghana),* May 8, 2013.

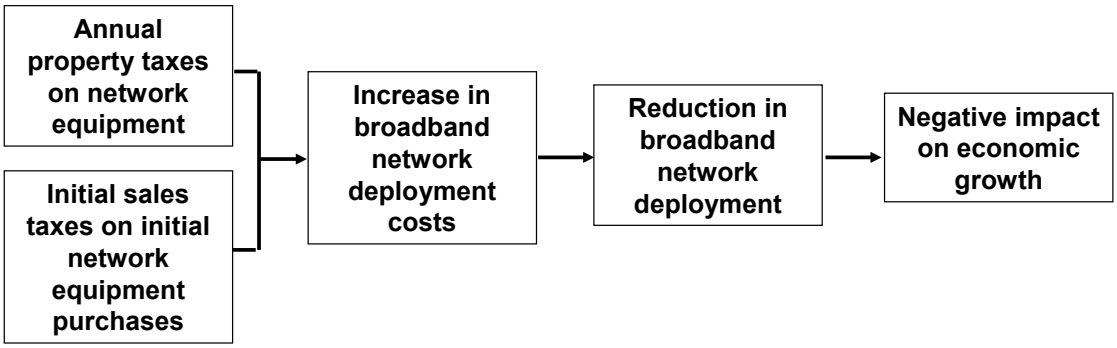
32 Import Duty Calculator www.dutycalculator.com/popular-import-items/import-duty-and-taxes-for-network-equipment/

33 See Bierbaum, D., Fenwick, J. and Mackey, S. (2011). *Property Tax Discrimination: Barrier to broadband*. Presentation at the ALEC Spring Conference. Cincinnati, OH, April 29, 2011.

property of telecommunication companies than the ratio applied to property of general businesses. In another case of discriminatory practices, some states in the United States apply higher tax rates to the property of broadband providers companies. The Colombia Government also collects property taxes ranging between 0.1 per cent and 1.6 per cent of the value of physical assets.

Direct taxes (particularly annual property levies on network equipment and sales taxes imposed on initial network equipment purchases) imposed on ISPs have a negative economic impact. The underlying causality of this effect is depicted in figure 3.

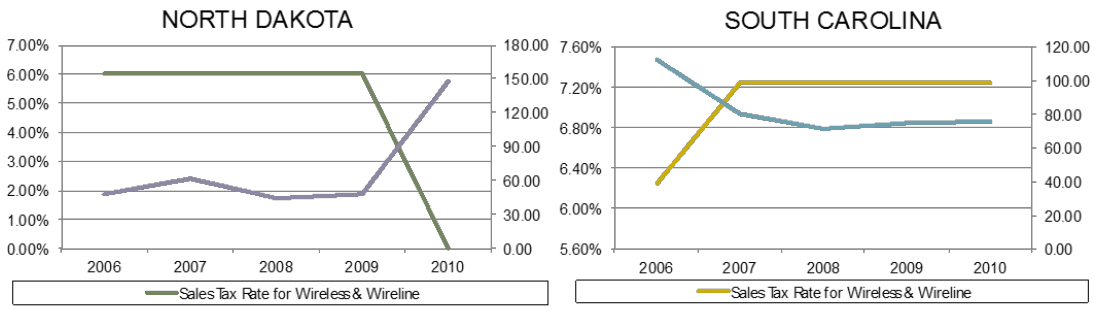
Figure 3: Impact of taxes on broadband network investment



Source: ITU

According to the logic presented in Figure 3, taxes on network equipment in the two dimensions mentioned above – property taxes and sales tax on equipment - tend to affect the deployment of broadband infrastructure by telecommunication carriers and cable TV operators. Suppliers of broadband services have their capital investments pre-determined by financial benchmarks (e.g. carriers typically tend to spend 13 per cent of their sales in capital expenditures). Taxes on equipment purchases negatively impact deployment. For example, in a study done by the author, the negative effect of the sales tax rate and capital spending of telecommunication companies in the United States was verified in specific states (see the examples in Figure 4).

Figure 4: Sales tax rate on telecom equipment and telecommunication capital spending (2006-2010)



Source: Katz, R., Flores-Roux, E., and Callorda, F. (2012). Assessment of the Economic Impact of Taxation on Communications Investment in the United States. New York: Telecom Advisory Services LLC

In North Dakota (chart on the left), the state government adopted a six-year phase-out of the sales tax on network equipment purchases. As a result, telecommunication investment increased three-fold from USD 48 to USD 148.30 per capita. In an opposite case, South Carolina (chart of the right) increased the sates tax rate from 6.25 per cent in 2006 to 7.25 per cent in 2007. The resulting effect was that telecommunication investment decreased 33 per cent from USD 115.37 to USD 77.44 per capita.

Based on the well-proven evidence that broadband has a positive impact on economic growth and job creation34, a reduction in deployment will have a negative impact on penetration and, consequently, diminished macro-economic contribution. Conversely, a reduction in taxation could result in an increase in capital invested in broadband. An acceleration of deployment will have an impact on broadband penetration, which by having a positive impact on the economy actually increases the base over which taxes can be collected, while contributing to job creation and growth.

According to the above rationale, some governments have exempted ISPs from paying sales tax on equipment. For example, Malaysia approved tax allowances on expenditure on last-mile broadband equipment as an incentive for operators to roll out their networks35. Among them, last mile network facilities providers are given an investment allowance of 100 per cent on capital expenditures incurred for broadband for a limited period of time. This approach to taxation reflects a government policy aimed at promoting broadband adoption throughout the economy.

2.4 Over-the-top (OTT) players taxation

The delivery of OTT content refers to the distribution of audio, video and other media over the Internet without the involvement of a distributor, such as a cable TV operator, in the control or management of the material. This model contrasts with the acquisition or rental of content from an ISP. Additionally, OTT platforms enable the distribution of targeted advertising, which have the capability of leveraging their deep understanding of customer demographics. Finally, OTT platforms include merchants capable of conducting all commercial transactions online leading to the purchasing of a physical good. Table 2 presents global revenues of several operators providing services operating over-the-top.

Table 2: Global annual revenues of OTT firms (in USD '000) (2013)

Category	Player	Revenues
Content providers	Netflix	USD 4 374 562
	Google	USD 15 707 000
Digital advertisers	Twitter	USD 664 890
	Facebook	USD 2 585 000
E-commerce	Amazon	USD 74 450 000
	EBay	USD 16 050 000

Source: Annual Reports

The growth in business of OTT players raises the issue of how to tax the distribution of digital goods. For the time being, however, those have been largely untaxed. This situation applies not only when they are provided by foreign operators, but also in many cases, within a given country.

2.4.1 Content providers

OTT content comprises a range of digital goods and services, such as e-books, digital music, applications and video streaming. Taxation of digital content, in particular video streaming services such as Netflix, varies by country and even, within countries. Part of the variance has to do with the struggle to define what digital content is. In general terms, two options are available for classifying goods and services in order to determine their sales tax rate: tangible personal property or enumerated services. Beyond

[34] See Katz, R. (2012). *Impact of broadband on the economy: research to date and policy issues*. Geneva: International Telecommunications Union.

[35] Katz, R. and Berry, T. (2014). *Driving demand of Broadband Networks and Services*. London: Springer, p. 141

determining whether a digital good falls into one or the other category, it should be established whether it makes a difference if the good is streamed over the top or downloaded directly to a device.

As of today, there is no consensus among policy makers as to what category should digital goods fall into, or whether a digital good should be taxed at all. For example, in the United States several states impose no sales tax on digital goods. California applies sales tax only to tangible products, which implicitly excludes digital goods. Missouri, and Virginia have ruled that video streaming content is not subject to sales tax. However, other states, such as Colorado, have extended the definition of tangible personal property to digital goods. In order to fit digital goods into the tangible personal property category, the state of Louisiana defines the latter to include anything "perceptible to the sense", which encompasses software, electronic files, "on demand" video and audio downloads. Finally, some states exempt digital goods from taxation but apply a communications service tax to video streaming.

Video and audio streaming presents policy makers with an interesting quandary when it comes to taxation. Unlike regular downloads, like a song from iTunes, where the purchaser owns the rights to the content that is stored in his or her device, audio and video streamed content is only "used" by the acquirer for a limited period of time36. This would be similar to a leasing transaction. In order to deal with this issue, some governments determined that streaming video and music content should be subject to a tax similar to the sale of a cable TV subscription.

Another layer of complexity in taxing digital goods has to do with the physical location of purchasing. For example, the acquisition of the digital good may be conducted at one location, while the property (content) resides on a server located at another location, and the user consuming the good is resident in yet a third site. Under these conditions, which location should apply the sales tax? The source one, the one where purchasing took place or the one where consumption actually occurs? To make things even more complex, what happens if the good (say, a Netflix subscription) is consumed by more than one individual located in a different site?

Part of the inconsistency in the taxation treatment of digital goods relates to the fact that policy makers are trying to fit video streaming, as a new service, within pre-existing frameworks and classifications37. This problem is starting to be addressed in countries like the United States, where the Streamlined Sales Tax Project was created to standardize definitions of digital products with the purpose to adapt sales and use taxes to the new era. While affiliation to the project is voluntary, already 23 states have become full members. Among the rules the project has established, the sourcing guidance is quite useful:

- If the digital good is received by the purchaser at the location (country or state) of the seller, sales tax is collected at that location.
- If the product is not received at the location of the seller, sales taxes are paid at the location where the purchaser receives the product (assuming the seller knows where that location is).
- If neither case applies, the seller should attempt to find an address for the purchaser at the time of the transaction.
- Yet, if the last case is not applicable, taxation should occur at the location of the seller.

In this context, some local jurisdictions in the United States have imposed a 9 per cent tax on cloud services. For example, a tax requiring users of streaming entertainment services (like Netflix) and online databases or computing platforms (such as Amazon) was introduced in the city of Chicago38.

The issue of taxation of digital goods, particularly video streaming services, has started to be raised in other geographies beyond the United States. In Europe, in order to respond to a significant loss of cable television customers to streaming services, regional tax authorities are implementing VAT to be levied on subscribers rather than providers. Implementing such measures could prove highly

[36] Jensen, J. and DoVale, A. (2014). "The next debate: Taxation of Digital Goods and Services". *The Tax Adviser*.
[37] Sawyer, David (2014). "Netflix Streaming Suits Highlight Tax-Tech Mismatch", *Taxanalysts*.
[38] Cullen International. *Taxing cloud services: trends from America*. 9 July, 2015.

difficult given the range of local VAT rates across locations39. In a highly publicized case, the French government introduced a 2 per cent tax on video on demand from foreign operators40. Since January 2015, international online video streaming services are liable for payment.

The move in France came together with the issuance of the EU VAT directive for electronic B2C services, implemented in January of 2015. Echoing the discussion in the United States, the new European VAT rules shift the country of taxation from the location in which the service provider is located to the place where the consumer purchases the good41. A location of a consumer is defined as where the customer is registered, has its permanent address, or usually lives. Consumer location will be identified either through the IP address of the device or the address in the credit card. If the customer lives outside the European Union but "uses and enjoys" the good within its boundaries, then VAT is charged at the place of consumption. To identify the location, the rule assumes that the Wi-Fi hot spot, restaurant or hotel indicate place of use. The new tax affects not only Netflix and Amazon, but also iTunes, Google Play and Microsoft.

Similarly, Japan has also announced that effective October 2015 it will impose a consumption tax on payments for digital goods purchased from overseas suppliers. This new regulation requires off-shore digital content providers that distribute digital products to consumers in Japan to register with the Japanese tax authorities, appoint tax administrators, file returns and pay taxes in Japan42.

In a move aimed at protecting local content distributors, the Brazil movie authority *Agencia Nacional Cinematografica* (Ancine) has required Netflix and Apple TV to pay a fee equivalent to USD 1 400 for each movie, and USD 340 for each episode of a TV show distributed in Brazil43. Considering the size of the catalogue of both operators, the tax would amount to approximately USD 5.5 million per annum44.

In a similar move, the South Africa Government electronic services regulations enacted in June 2014 imposed a 14 per cent VAT on foreign services who "sell e-books, music and other digital goods and services45.

2.4.2 Digital advertisers

As of 2014, the digital advertising sector (both in fixed and mobile devices) represented 12.1 per cent of global advertising spend (or USD 132 972 million), overtaking newspapers and consumer magazines combined. Of this amount, North America represents USD 41 830 million (or 31%). Digital advertising spend is growing at 10.7 per cent worldwide, although advertising in mobile devices is increasing at 21.5 per cent indicating a shift to wireless devices46.

Internet based advertising comprises three components: display ads, search ads, and native advertising. Display ads represent the original approach to online advertising and are in the form of banners, which advertisers pay to have posted on web sites. Search advertising was originally developed by Overture but expanded to its current configuration by Google, through implementation of a two sided-market, where consumers search for content, and are presented, in addition with the requested content, with web links related to the content that is being searched. In this context, advertisers are required to bid

---

39 The standardization of VAT rates across European countries is currently being addressed through the recently launched initiative: European Commission. *A Digital Single Market for Europe; Commission sets out 16 initiatives to make it happen*. Brussels, May 6, 2015.

40 See Nigmatulina, K. (2014). "France introduces new tax on VoD operators based abroad". *HIS Technology.*

41 The "destination principle" is a means of reducing both potential double taxation (meaning that the good is taxed in both the source and the destination country) and under-taxation (when neither country imposes a tax).

42 Baker & McKenzie. (2014). *Japan to impose consumption tax on payments for digital products or services provided by overseas suppliers*. April.

43 See Variety (October 2013). "Netflix to distribute 'Apenas o fim' worldwide".

44 Netflix has confronted demands for local payment of taxes in Argentina, and Canada, among others (see section 4.3 below).

45 See Business Tech (February 2014). "Why digital tax is good for South Africa"; Vermeulen, J. (2014). "New digital tax for South Africa postponed", *mybroadband.*

46 PricewaterhouseCoopers. *Global Entertainment and Media Outlook 2014-2018*. Internet Advertising.

on search keywords. The placement of the ad in the list resulting from the consumer search depends on the amount of the advertiser's bid (the higher the bid, the higher the position of the add in the list of ads). Native advertising integrates ads into the content and context of the user's experience. Unlike banners, native ads appear in non-traditional ad positions in a user's content stream (such as the Facebook Newsfeed, Tumblr, Pinterest, or Twitter Promoted Tweets)47. The position of the ad in the user's stream is also contingent upon a bid amount (the higher the bid, the most prominent position in the feed).

Pricing for digital advertising responds to different models. Originally, ads were priced according to their position in the site (this reflected traditional advertising pricing methods). Over time, pricing shifted to formulas driven by performance. For example, Google includes in its pricing formula a cost-per-click factor, which means that revenues materialize once the user clicks on the ad. However, in an attempt to push pricing further to reflect customer "engagement" rather than "clicking", digital advertisers generate income through a "cost per action" formula, where income is generated when the user takes an action that benefits the advertiser (for example, register in a site, purchase a product, click the "like" button on a Facebook page)48. This point will become increasingly important from a taxation standpoint because according to the price per performance approach, it is the end user that, while it receives the service for free, is the agent that triggers income generation. In other words, if the end-user does not "engage", the advertiser does not pay the publisher.

The two-sided or multi-sided nature of Internet platforms engaged in digital advertising presents a number of taxation challenges. Contrary to raising taxes as a result of a transaction involving a seller and a buyer, in digital advertising the revenue is generated when the user, who is getting the ad for free, has acted in a way that triggers income recognition49. As mentioned above, Google's pricing algorithm is based on actual "click through rate" as a variable affecting the original bid. In this context, the pricing model of digital advertisers involves three parties (the publisher such as Google, the advertiser, and the user), each of which could be located in different jurisdictions or countries.

Under the principles of cross-border taxation, a country has a right to tax income that is economically related to it by way of where it is generated (source-based) or where the good is being consumed (residency-based)50. Countries tend not to uniformly adhere to one or the other system. For example, the United States follows a mix of both principles (depending on the place of residence and whether income is generated within the country). In the context of taxation of online advertising, determining the source of the income remains a critical issue. Let's assume a three country advertising transaction where the server where the ad is published is based in country Y, the advertiser resides in country X, and the customer clicking on the ad resides in country Z. Where is the source of income?

An emerging view posits that online advertising should be taxed in three jurisdictions (where the servers are located, where the employees delivering the services reside, and the place of residence of end-users that trigger the income-generating transaction). The first two categories of jurisdiction are self-explanatory, while the third one raises some sourcing problems51. In addition, complexity would arise in terms of calculating the portion of income to be distributed across the three jurisdictions.

2.4.3 Electronic commerce

Electronic commercial transactions, such as the purchasing of goods and services by consumers, has been increasing significantly over time. Figure 5 provides evidence regarding the growth of e-commerce as a percentage of total retail commerce not only in the industrialized world but also in developing countries.

---

47 Katz-Samuels, Cora. (2014). Native advertising: Beyond the Buzz. New York: Neo@Ogilvy viewpoints.

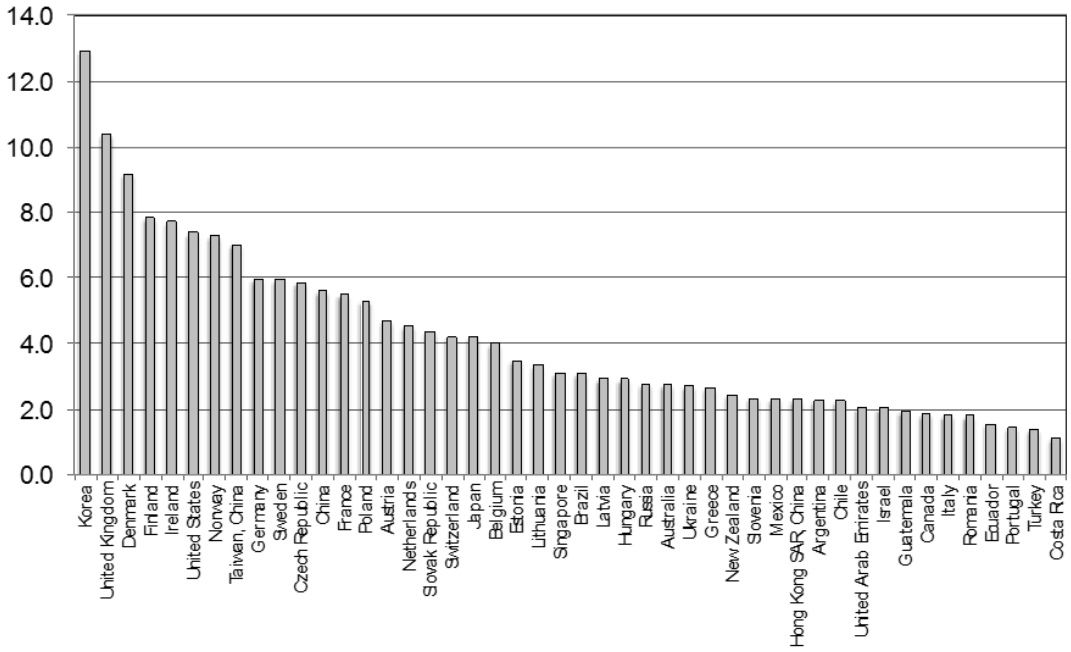
48 A review of digital advertising see Charlesworth, A. (2007). *Key Concepts in e-Commerce 3*. Palgrave Key Concepts.

49 Prussak, A. (2013). *The income of the 21st century: Online advertising as a case study for the implications of technology for source-based taxation*. Retrieved at http://ssrn.com/abstract=2206745 Electronic copy available at: http://ssrn.com/abstract=22067

50 Avi-Yonah, R. (1997). *International Taxation of Electronic Commerce*, 52 TAX L. REV. 507

51 Prussak, A. op. cit.

Figure 5: Internet retail as a percentage of total retail (2013)



Source: Euromonitor

While e-commerce is still a small percentage of total retail trade in relative terms (the Republic of Korea, the highest country, is around 12%), business to consumer e-commerce sales were estimated to exceed USD 1 trillion worldwide in 2012 (eMarketer, 2012).

The increasing rate of international e-commerce transactions has brought to the forefront the policy discussion of whether to collect taxes over online sales. The first warning was issued by the U.S. Treasury department in 1996 when a discussion paper raised the issue that e-commerce developments would result in revenue losses or other detrimental outcomes such as an increased use of tax havens for tax avoidance purpose52. First and foremost, as Internet sales reach sizable portions of total retail trade, governments fear losing large amounts of tax revenues. Secondly, when products are shipped internationally, inconsistent Internet tax policies can encourage the deployment by online retailers in tax havens to avoid tax liabilities53. As a consequence, taxation of e-commerce has both domestic and cross-border dimensions.

At the domestic level, some countries have, despite the growing share of online transactions, exempted e-commerce transactions from sales taxes. For example, in a recently re-enacted bill (Internet Tax Freedom Act), the United States has imposed a moratorium on discriminatory taxes on e-commerce. A "discriminatory tax" is defined as a levy that is not generally imposed through other means. For example, if sales taxes of a good are not collected through a mail order catalogue system, they cannot be collected from online purchases. In specific terms, consumers do not pay taxes on goods purchased online if the seller resides in a state with no sales tax. Additionally, the Act prohibits the collection of multiple taxes through double taxation.

In terms of cross-border trade, the issues are more complex when they result from purchasing a good online from a foreign location. The first issue relates to the definition of what constitutes "permanent establishment" of an online retailer in a given country. If that is the case and the e-commerce player has a location (such as a warehouse or a data centre) in a given country, the retailer is liable for

[52] Office of Tax Policy, U.S. Dept. of The Treasury (1996). *Selected Tax Policy Implications Of Global Electronic Commerce.* Washington, DC.

[53] Simkin, M.; Bartlett, G., and Shim, J. (2003). "Pros and cons of E-Commerce Taxation", *International Business and Economics Research Journal*, vol. 1, 2, pp. 61-71.

payment of sales taxes in that country. Along these lines, the OECD considers that if the retailer has a server that displays information, takes orders and assigns distribution schedules in a given country for a "sufficient period of time", that should be considered "permanent establishment". On the other hand, if the server is located in an offshore location, e-commerce retailers pay sales taxes (usually at a low rate, if any) from the latter location, and only are subject to taxation when they repatriate profits to the home country at the appropriate rate54.

The arguments for and against e-commerce taxation are multifold. The most argued point for taxation is that an exemption would create an unfair advantage vis-a-vis conventional retailers, especially small outlets that lack the capability to deploy a technological platform. The second point is that, given the growing trend of e-commerce transactions, an exemption would be excluding governments from an important source of revenues. Estimates for the United States show that only 20 per cent of all e-commerce transactions are taxed (of a revenue base of USD 226 billion)55. The third point argues that, since e-commerce is, at least initially, prevalent among higher income purchasers, an exemption would benefit those that can actually afford the sales tax, penalizing the low income segments of the population.

The arguments against e-commerce taxation are also numerous. First, it is argued that, given the diversity in rates, exemptions, and locations, enforcing an Internet sales tax is impractical. Following this, creating supervision and enforcement capability would be extremely cumbersome, cancelling out some of the revenues to be collected. Some analysts even argue that, due to the informational needs required to collect Internet sales taxes, taxing Internet sales would constitute an infringement of privacy. As location of consumption is difficult to determine, tax authorities would have to request credit card companies to provide information on consumers and their purchasing activity.

Interestingly enough, Amazon, the largest world e-commerce player supports the Internet sales tax (at least in the United States). The company considers that same-day shipping is an advantage favoured by customers. However, in order to provide this capability, the retailer has to establish warehouses in many states, thereby fulfilling the "permanent establishment" rule making it liable for collection of sales taxes. According to Amazon, a fulfilment competitive advantage greatly exceeds the imposition of a sales tax (and consequently, higher prices to consumers).

In order to decide whether this should become a key issue, policy makers should consider whether the rise of the Internet has impacted or will in the near future affect sales tax collections. While Internet usage has reached increasingly high levels across the world, it does not necessarily result in a proportional increase in online sales. These are dependent not only on Internet access but also on the existence of reliable payment, security and fulfilment systems. Until those emerge in a given country, one should expect e-commerce to remain a marginal percentage of total retail transactions. In this case, it might be advisable to governments not to engage in addressing this issue for the time being. In fact, a survey of initiatives taken by national governments in response to the challenges posed by cross-border electronic commerce shows limited move on their part56. This situation appears to have changed with the recent European Commission proposal for a "Digital Single Market Strategy for Europe"57.

2.5 Applications providers

Software applications are typically imposed a sales tax to final users, but they are exempted if purchased by business users. However, taxation treatment can change whether software is purchased in the form of tangible property, like a disk, or if it is downloaded directly into a computer. This difference is

---

54 OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. OECD/g20 Base Erosion and Profit Shifting Project, OECD Publishing, p. 184.

55 Zeiler, D. (2013). "Internet Sales Tax Sticks it to the Nation's little guys" *Morning Money*, April 23.

56 Source: Cockfield,A. "The Rise of the OECD as Informal; World Tax Organization; Through National Responses to E-commerce Tax Challenges", *Taxblog. January 23, 2014.*

57 See European Commission. A Digital Single Market Strategy for Europe- Analysis and Evidence.

critical in terms of the tax regime to be followed by the application provider sites, such as the Apple app store. In general terms, application provider sites charge taxes only in jurisdictions where digital goods are taxable (see section 2.4.1). The tax rate is based on the purchaser's address and the sales tax rate in effect at the time the product is downloaded.

The taxation complexity in the case of apps arises at numerous stages of the transaction. For example, if the sale of the app is conducted by a US-based software developer for a nominal fee to a user outside the United States, premium features can be sold to users for a monthly fee and revenue could also be generated through the placement of ads within the app58. This transaction is, in essence a cloud-based sale, which gives rise to VAT and income tax liabilities in some countries. For example, while taxation of cloud commerce is not addressed under Chinese legislation, this transaction could be characterized as a software license in China, which would make the provider liable of income taxes from a royalty.

On the other hand, in Europe, the tax liability would require the software company to charge an EU Member State VAT to the consumer. However, due to the lack of harmonization, applicable rates might change by Member State. As shown, taxation regimes of application providers can vary greatly across countries.

3 A typology of taxation regimes in the digital sector

3.1 Taxation trends and fiscal policy in the digital economy

Reflecting the growing shift to digital platforms in commerce, advertising, and content distribution, taxation is becoming an increasingly important topic. Two opposing trends can be detected in terms of fiscal policy in the digital economy: one is to maximize collections based on growing digital flows; the second one is to recognize that lowering taxation benefits consumers and businesses.

According to the first trend, some governments recognize growing digital flows to become critical in their generation of revenues and are putting in place more mechanisms to maximize collection in these domains of economic activity. For example, in the United States wireless tax burdens have increased since 2006. The combined federal, state, and local burden on wireless consumers increased from 15.27 per cent to 17.05 percent, or nearly 2 percentage points. Underlying the discriminatory trend, overall tax burdens on wireless consumers grew about three times faster than general sales taxes on other taxable goods and services59.

On the other hand, some countries consider that lowering taxes on the digital sector of the economy triggers spillovers that are larger than the foregone taxes. For example, until 2008, mobile subscribers in Ecuador were subject to a 15 per cent excise tax applied to mobile usage and subscriptions, over and above the 12 per cent VAT. In that year, the government abolished what was considered to be a luxury tax, and cellphone usage (as measured by minutes of use) increased 40 per cent. Similarly, in Uruguay, the mobile usage tax was abolished in 2007, resulting in an increase of over 60 per cent in penetration (from 65 per cent to 141 per cent)60. Along the same lines, Brazil recently reduced taxes on M2M communications. In the same vein, Pakistan reduced the SIM card sales tax from PKR 2 000 to PKR 250 in five years (2005 to 2009). During that period, SIM card penetration increased from 5 per cent to 55 per cent, reaching 70 per cent in 201461.

---

58 Faraq, R. (2013). Practitoners from three continents discuss international tax implications of mobile app sales.
59 Mackey, S. and Henchman, J. (2014). *Wireless Taxation in the United States 2014*. Tax Foundation Fiscal.
60 Source: GSMA (2015). *Digital inclusion and mobile sector taxation in Pakistan*, p. 44.
61 Source: Pakistan Telecommunications Authority.

Some governments also reduce corporate taxes to telecommunication operators. For example, while the Panama Government had been reducing its corporate tax rate on profits from 30 per cent to 25 per cent in 201162, ICT/telecommunications continued to pay corporate taxes at 30 per cent rate. This distortive rate expired in 201463.

To illustrate the difference in country approaches, the next section will analyse different taxation regimes of wireless services.

3.2 Regional and country differences

Countries do not follow a uniform approach to mobile services taxation. While virtually all countries tax both services and handsets, the type of taxes selected and their amount vary significantly, with the consequential varying impact on total cost of ownership and use of a mobile device. Handset taxes increase the acquisition cost and service taxes the recurring expenses.

In 2010 the author, as part of a research team, performed a cluster analysis of wireless telecommunication taxation approaches across 80 countries, attempting to isolate mobile telecommunication tax policy differences64. The study begun by clustering the taxation approaches based on types of levies and rates and concluded that mobile service tax policies could be categorized around four approaches:

- **Universalization of service**: reduce taxes as much as possible to stimulate wireless adoption.
- **Direct taxation without sector discrimination**: establish a high uniform VAT to all sales without adding sector specific taxes in recognition of their distortion effect.
- **Direct taxation and sector specific taxes**: combine VAT with a sector specific levy.
- **Service tax revenue maximization**: leverage mobile communications as a source of direct taxation, by combining high VAT, high sector specific taxes and/or a fixed levy.

The study then proceeded to isolate handset taxation approaches, concluding that four taxation approaches could be identified as well, partly driven by the existence or not of import duties:

- **Sector discrimination based on the absence or moderate import duty**: VAT combined with low duty.
- **Sector discrimination based on high import duty but no telecom tax**: high import duty and VAT but no sector specific taxes on handsets.
- **Sector discrimination based on high VAT and import duty but low handset specific tax**: combine high VAT with a sector specific levy.
- **Handset tax revenue maximization**: leverage mobile communications as a source of direct taxation, by combining high VAT, high customs duty and a high sector specific levy or low import duty and high sector specific tax.

Following the methodology of the 2010 study, the clustering analysis was replicated by this author, relying this time on 2014 data compiled from the ITU ICTEye Tariff Policies Survey, the GSMA, and *Import Duty Calculator*. The study began by replicating the analysis of mobile service taxation, confirming the existence of distinct approaches.

Confirming the findings of the 2010 study, the analysis of service taxation for 2014 indicated that, while most developed and some developing countries reduce service taxes to promote universalization of service, the pattern is not consistent across countries. For example, the Africa and Asia-Pacific regions

---

62 KPMG (2015). *Corporate tax rate tables.*

63 Law 8 of 15 March 2010. The distortive rate included banking, power generation, cement manufacturing, insurance, casino and gambling activities.

64 Katz, R., Flores-Roux, E. and Mariscal, J. (2010*). The impact of taxation on the development of the mobile broadband sector*. London: GSMA, pp. 11-16.

comprise some nations with taxation approaches aimed at universalizing mobile services, while this approach is significantly less prevalent in Latin America (see Table 3).

Table 3: Service taxation approaches by country (2014)

Region	Universalization of service	Direct taxation without sector discrimination	Direct taxation and sector specific taxes	Service tax revenue maximization
Africa	Angola, Lesotho, Namibia, Rwanda	Botswana, Cameroon, Chad, Cote d'Ivoire, Ethiopia, Gabon, Guinea, Guinea-Bissau, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Seychelles, South Africa, Tanzania, Togo	Burkina Faso, Congo, Gambia, Ghana, Malawi, Nigeria, Zimbabwe	Democratic Republic of Congo, Kenya, Madagascar, Senegal, Sierra Leone, Uganda, Zambia
Americas	Paraguay	Bolivia, Chile, Colombia, Guatemala, Nicaragua, Peru, Trinidad and Tobago	Brazil, Mexico	Argentina, Dominican Republic, Ecuador, Venezuela
Arab States	Syria, Yemen	Egypt, Mauritania, Morocco	Jordan, Tunisia	Turkey
Asia-Pacific	Indonesia, Lao, Malaysia, Myanmar, Papua New Guinea, Thailand, Viet Nam	India, Philippines, Samoa	Cambodia, China, Iran, Sri Lanka	Bangladesh, China, Nepal, Pakistan
CIS		Azerbaijan, Kazakhstan, Russia, Uzbekistan		Albania, Georgia, Ukraine
Europe	Austria, Bulgaria, Cyprus, Czech republic, Denmark, Estonia, France, Finland, Germany, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, United Kingdom	Norway		Greece

Source: 2014 data from ITU ICTEye Tariff Policies Survey, GSMA, and Import Duty Calculator

The same analysis was then replicated with 2014 data for handset taxation. Again, different country approaches for taxing handset were identified. The approach to handset taxation is anything but consistent. One model combines high VAT with no customs duty (South Africa), while another model includes high VAT and customs duty rate, complemented with high sector specific taxes (Brazil).

When clustering the rest of countries in the sample, it was confirmed that the most prevalent handset taxation model around the world is based on VAT combined, in some cases, with low sector discrimination through moderate import duty. Still, some countries were noticeably approaching handset taxation with the purpose of raising revenues through high import duties (for example, Argentina, Botswana, Ukraine). In some cases, the stated purpose of this policy was to protect local manufacturing or assembly operations (Argentina, Brazil, and China) (see Table 4).

Following the methodology originally used, service and handset taxation approaches were combined yielding four approaches to the taxation of wireless consumption:

- **Universalization and protectionism:** this approach aims at reducing levies with the purpose of decreasing as much as possible the total cost of ownership and stimulating wireless adoption;

Table 4: Handset taxation approaches by country (2014)

Continent	Sector discrimination based on no or moderate import duty	Sector discrimination based on high import duty	Sector discrimination based on high VAT and import duty but low handset specific tax	Handset revenue maximization
Africa	Angola, Ethiopia, Gabon, Guinea-Bissau, Kenya, Mauritius, Rwanda, South Africa, Tanzania, Uganda, Zambia, Zimbabwe	Cameroon, Chad, Democratic Republic of Congo, Gambia, Guinea, Malawi, Mali, Namibia, Niger, Seychelles, Sierra Leone, Swaziland, Togo	Botswana, Burkina Faso, Cote d'Ivoire, Ghana, Madagascar, Mozambique, Nigeria, Senegal	Lesotho
Americas	Bolivia, Chile, Dominican Republic, Guatemala, Mexico, Nicaragua, Paraguay, Peru	Argentina, Brazil, Ecuador, Trinidad and Tobago, Venezuela	Colombia	
Arab States	Egypt, Jordan, Mauritania, Morocco		Syria, Turkey, Yemen, Tunisia	
Asia-Pacific	Indonesia, Iran, Lao, Malaysia, Papua New Guinea, Philippines, Thailand, Viet Nam	Bhutan, Cambodia, China, Myanmar, Samoa	India, Nepal, Pakistan, Sri Lanka	Bangladesh
CIS	Albania, Azerbaijan, Kazakhstan, Russia, Uzbekistan	Georgia, Ukraine		
Europe	Austria, Bulgaria, Czech Republic, Denmark, France, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland, United Kingdom	Estonia, Greece	Cyprus, Slovakia	

Source: 2014 data from the ITU ICTEye Tariff Policies Survey, GSMA, and Import Duty Calculator

it can include a handset import duty and a sector specific handset tax (which is relatively low and therefore has minimum distortion potential).

- **Protectionism:** this approach is similar to the one above, except that high value-added taxes on service increase substantially the total cost of ownership.
- **Sector distortion:** this approach introduces sector specific service taxes with the objective of increasing government revenues but, in doing so, plays an economically distortive role by emphasizing taxes on the telecommunication sector.
- **Tax maximization and sector distortion:** sector specific taxes are introduced not only on mobile services but also on devices with the purpose of maximizing government revenues, with the consequent high distortion impact.

Examples of countries following each of these four approaches based on 2014 data can be visualized in Figure 6.

As pointed out before, prevalent taxation models tend to differ by region. As expected, most developed countries have adopted universalization and protectionism tax approaches given that they do not need to rely on the telecommunication industry to increase revenues for the treasury. In addition, there are a number of countries with emerging market economies that have chosen a universalization and protectionism approach in order to stimulate telecommunication service adoption. Notable examples in this category are Angola, Indonesia, and Malaysia.

Figure 6: Combined taxation approaches (2014)

		Service taxation			
		Universalization of service	Direct taxation without sector discrimination	Direct taxation and sector specific taxes	Service tax revenue maximization
Handset taxation	Sector discrimination based on no to moderate import duty and telecom tax	Malaysia Angola	South Africa Chile	Mexico Iran	Zambia
	Sector discrimination based on high import duty but no telecom tax	Myanmar	Trinidad & Tobago	China Venezuela	Argentina Greece
	Sector discrimination based on high VAT and import duty but low handset specific tax		Botswana Colombia		Turkey Pakistan
	Handset tax revenue maximization				Bangladesh

Universalization and protectionism | Protectionism | Sector distortion | Tax maximization and sector distortion

Source: 2014 data from the ITU ICT-Eye Tariff Policies Survey, GSMA, and Import Duty Calculator

In the next category of taxation approach-protectionism- countries with emerging market economies that have adopted pro-active ICT development strategies can also be identified (for example, Colombia, India, and South Africa). In other words, the first two taxation categories are associated with technology development objectives.

At the other end of the spectrum there are also some significantly large countries with emerging market economies where the taxation approach runs counter to maximizing telecommunication adoption. Table 5 provides the position of all countries of the study dataset.

Table 5: Overarching taxation approach by country (2014)

	Universalization and protectionism	Protectionism	Sector distortion	Tax maximization and sector distortion
Africa	Angola, Lesotho, Rwanda, Swaziland	Botswana, Cameroon, Chad, Congo, Cote d'Ivoire, Ethiopia, Gabon, Guinea, Guinea-Bissau, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Seychelles, South Africa, Tanzania, Togo	Kenya, Uganda, Zambia, Zimbabwe	Burkina Faso, Democratic Republic Congo, Gambia, Ghana, Madagascar, Nigeria, Senegal, Sierra Leone
Americas	Paraguay	Bolivia, Chile, Colombia, Guatemala, Nicaragua, Peru, Trinidad & Tobago	Dominican Republic, Mexico	Argentina, Brazil, Ecuador, Venezuela
Arab States	Syria, Yemen	Mauritania, Morocco, Egypt	Jordan	Turkey, Tunisia
Asia-Pacific	Indonesia, Lao, Malaysia, Myanmar, Papua New Guinea, Thailand, Viet Nam	India, Philippines, Samoa	Iran	Bangladesh, Cambodia, China, Nepal, Pakistan, Sri Lanka
CIS		Azerbaijan, Kazakhstan, Russia, Uzbekistan	Albania	Georgia, Ukraine

Table 5: Overarching taxation approach by country (2014) (continued)

	Universalization and protectionism	Protectionism	Sector distortion	Tax maximization and sector distortion
Europe	Austria, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, France, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom			Greece

Source: 2014 data from the ITU ICTEye Tariff Policies Survey, GSMA, and Import Duty Calculator

A comparison between the results of the 2010 study and the analysis presented above indicates a remarkable consistency. Most countries have continued to implement similar approaches to wireless taxation. In fact, some countries have moved to implementing more stringent approaches. Most of these belong in emerging market economies (e.g. Botswana, Democratic Republic of Congo, Ecuador, Georgia, Sierra Leone, and Ukraine).

3.3 The impact of taxation on wireless adoption

In general terms, since high taxation increases the total cost of ownership of wireless services, it is correct to consider that higher wireless consumption taxes will raise the affordability barrier and reduce adoption. A correlational analysis indicates that technology adoption proceeds at a slower pace in countries with high tax burden on mobile. This is clearly the case in the European context (see Figure 7).

Figure 7 depicts two different correlations between tax burden on wireless service price and the growth in 3G penetration: one for western Europe, and the other one central and eastern Europe. In both cases, an increase in tax burden reduces the rate at which 3G penetration grows.

In the case of emerging countries, the relationship between taxation and rate of diffusion of mobile broadband can also be visualized, although continents would appear to follow different patterns and coefficients (see figure 8).

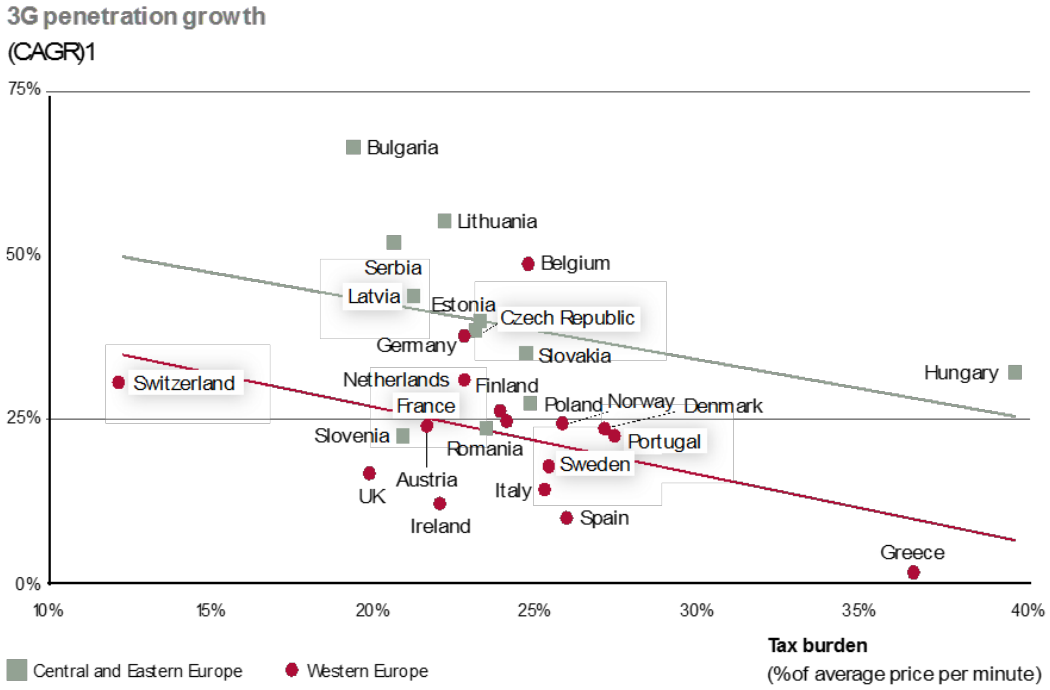
In the case of countries with emerging market economies, while the indirect relationship between tax burden and 3G penetration growth still holds, the correlation patterns between both variables appear to differ between Latin America (black regression line) and the Asia-Pacific region (orange regression line).

In this context, taxation could have a detrimental effect on the public policy strategy aimed at deploying mobile broadband. Examples of positive and negative effects are depicted in Table 6. With the exception of Malaysia, which has implemented a benign system based on extremely low value-added tax, the other countries have introduced taxes that could negatively affect service diffusion (see Table 6).

The impact of these different taxation approaches on total cost of ownership of mobile service varies widely. For example, in Mexico the impact of taxes on total cost of ownership is 15.18 per cent[65], in South Africa it is 15.2 per cent, in Brazil it reaches 29.8 per cent, while in Bangladesh it is 54.8 per cent. On the other hand, in Malaysia, the effect of taxes on mobile cost of ownership amounts to only 6.1 per cent.

[65] This estimate assumes a total cost of ownership (w/o taxes) of USD 1,311.51 based on a monthly ARPU of USD 8.76, and a terminal replacement rate of 24 months.

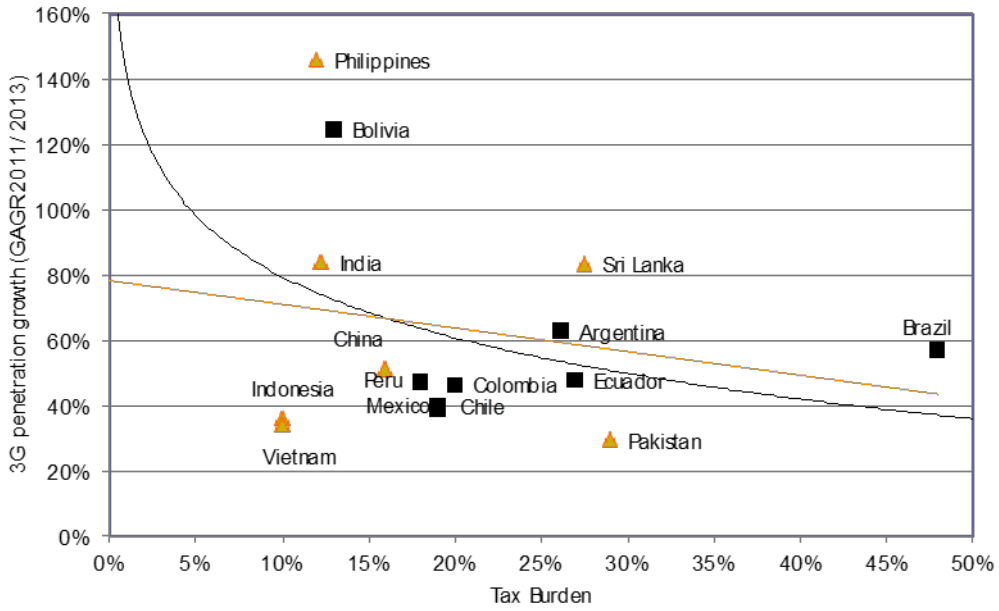
Figure 7: Tax burden and 3G penetration in selected European countries (2013)



[1] 3G penetration growth as a percent of population when comparing the fourth quarters of 2009 and 2012

Source: A.T. Kearney (2013)

Figure 8: Tax burden and 3G penetration in selected Latin America and Asia-Pacific countries (2013)



Sources: ITU; Telecom Advisory Services analysis

If taxes limit adoption of wireless broadband, it is relevant to ask what the ultimate impact of reduced penetration might have on economic growth. Hypothetically, it is safe to assume that a reduction in adoption as a result of incremental taxation could yield a negative impact on GDP growth.

Table 6: Mobile taxation approaches in five countries with emerging market economies (2014)

Country	Services			Handset				Taxation Approach
	VAT	Other Taxes	Fixed Taxes	VAT	Customs Duty	Other Taxes	Fixed Taxes	
Malaysia	6 %	0 %	0 %	0 %	0 %	---	---	Universalization and protectionism
South Africa	14 %	0 %	0 %	14 %	0 %	---	---	Protectionism
Mexico	16 %	3 %	0 %	16 %	0.10 %	---	---	Sector distortion
Brazil	27 %	3 %	0 %	25 %	19 %	---	---	Tax maximization and sector distortion
Bangladesh	15 %	35 %	USD 11.76	15 %	25 %	---	USD 11.63	

Source: 2014 data from the ITU ICTEye Tariff Policies Survey, GSMA, and Import Duty Calculator

4 Distortive taxation regimes in the digital economy

In principle, taxation should attempt to be neutral and equitable across all sectors of the economy. A distortion occurs when a change in the price of a good resulting from taxation triggers different changes in supply and demand from what would occur in the absence of taxes. The deviation in supply/demand equilibrium is defined as the deadweight loss (cost of taxation over and above the taxes paid to the government). In this sense, taxation regimes should seek to minimize discrimination for any particular choice.

4.1 Dimensions of distortion

As mentioned above, taxes generate distortions when they affect conditions guiding social efficiency. Taxes can create distortions if they affect the choices made by market agents, which in the digital space could be as follows:

- Consumers, particularly those that are price sensitive, limit the adoption of technology. This was discussed in section 3.3.
- Telecommunications operators reduce their rate of investment in infrastructure. This topic will be approached in section 6.1.
- Global digital technology providers adapt their deployment footprint according to a minimization of tax burden.
- Different tax regimes within the digital eco-system create asymmetries. This will be discussed in chapter 7.

The design of an efficient tax structure in the digital space needs to consider several somewhat contradicting requirements:

- Ensure proper collection of taxes for income generated at source.
- Avoid over taxation of digital activities when compared to other industries.
- Selectively provide exemptions to facilitate investment in infrastructure and promote adoption by end-users.

4.1.1 Sector discrimination through specific taxes

In general terms, economic theory has formalized the basic conditions under which sector specific taxes need to be considered:

- If the goal is to fund a programme (say broadband in schools) with as little loss as possible in economic surplus, sector specific taxes should focus on goods whose demand or supply is inelastic.
- Alternatively, if the goal is to change consumer or supplier behaviour, sector specific taxes should focus on goods whose supply and demand is elastic.

Discrimination in taxes in the digital space could emerge if:

- The rates at which taxes are collected are higher than in other sectors.
- The sector is affected by a large number of specific taxes with the potential of greatly affecting agent behaviour.

4.1.2 Taxation asymmetry

Three dimensions of taxation asymmetry exist when looking at tax burdens incurred by companies in the digital space. The first one refers to the disparity in tax burdens imposed on telecommunication operators when compared to Internet players of the digital eco-system (digital advertisers, social networks, etc.). The following analysis compares the effective tax rates (ETR)66 of wireless operators, convergent telecommunication operators (fixed and mobile and Internet firms). The ETR captures the taxes actually paid by companies as presented in their annual reports. The analysis was conducted at six levels: a global comparison, China, Europe, India, the United States, and emerging markets (see Table 7).

Table 7: Effective tax rates for telecommunication and Internet players (2014)

	Wireless telecommunications	Telecommunication services	Internet
Global	29.75 %	27.70 %	32.81 %
China	22.91%	22.71%	17.89%
Emerging markets	26.41%	19.64%	19.74%
Europe	13.48%	27.05%	22.57%
India	49.37 %	9.19 %	35.95 %
United States	21.78%	31.14%	35.06%

Note: Values correspond to the ratio of taxes to taxable income as reported in annual reports

Source: Damodaran Online, retrieved at http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

Table 7 presents data for wireless operators "pure plays" (such as Bharti Airtel, MTN, or Millicom) in the first column, for fixed and mobile telecommunication services companies (such as Verizon, Telefonica and Deutsche Telekom) in the second column, and for Internet companies (social networks, search platforms) in the third column. On a global scale, the asymmetry would seem to work in reverse: Internet companies pay more taxes than telecommunication operators. But once the comparisons are made at the country or regional level, the evidence points to the existence of asymmetry affecting the telecommunication operators. In Europe, Internet firms have a 5-point lower ETR than telecommunication service companies. In the case of countries with emerging market economies, Internet companies have a 7-point lower ETR than wireless operators. The fact that the difference does not show up in the case of telecommunication services firms could relate to the continued existence of

[66] For a detailed methodological discussion on effective tax rates, see section 7.1.

state-owned operators that are taxed on a more favourable basis than private enterprises. That would be confirmed with the data for India: it would appear that wireless telecommunication operators bear a burden that is 14 points higher than Internet firms. Finally, the difference would also appear to exist in China, where both wireless and full service telecommunication companies are taxed at a rate that is 5 points higher than Internet players. In sum, the analysis of taxes actually paid by firms in the three sectors would appear to confirm an asymmetry within the digital sector.

A second dimension of taxation asymmetry within the digital sector exists when one looks at global players. In general, the provision of telecommunication services in a given country requires the deployment of local infrastructure in the form of points of presence, interconnection points, switches and distribution networks. From a tax standpoint, this constitutes a "permanent establishment" and renders the service provider liable for payment of taxes, contributions, and telecommunication specific fees within that country. On the other hand, a global digital player that relies on the telecommunication operator infrastructure to access the end customer does not necessarily require having an in-country presence. This is directly related to the business model and operating processes of the global digital player, which is "asset-light" and benefits from having a centralized R&D and processing infrastructure (in the form of data centres located in the home country67). The derived value of this configuration is that, contrary to what happens with telecommunication service providers, global digital players (such as Facebook, Google, and Twitter) are liable for a much reduced tax burden in countries beyond that of their home office. Some digital players like the OTT operators do not even have a physical presence, all transactions are booked out of the country, and therefore, while they generate revenues and profits, they do not pay taxes. Other players, like the major digital advertising platforms (e.g. Google, Facebook) set up sales offices and therefore become liable for a small tax burden, derived from social charges for local employees, VAT for some goods purchased in-country, and, in some cases, some country-specific taxes68. This situation is not consistent across countries. In Chile, for example, advertisers purchasing services from Google are expected to subtract a 35 per cent tax on gross amounts invoiced by the operator.

For example, a recent study69 estimated the taxes paid by global digital players in Latin America and compared them with those paid by telecommunication service providers, and equipment manufacturers. According to these estimates, total taxes paid by Facebook, Google, Twitter, Skype, LinkedIn and Netflix in Latin America would amount to approximately USD 1.09 billion for a revenue base of USD 9.24 billion, which would represent an ETR of 11.78 per cent. On the other hand, telecommunication service providers70 pay an estimated USD 50.9 billion for revenues of USD 153 billion (equivalent to an ETR of 33 per cent), and telecommunication equipment manufacturers71 pay approximately 3.7 billion (from a revenue base of USD 25 billion, which results in an ETR of 14 per cent).

The third dimension of taxation asymmetry refers to in-country comparison of tax burden of the telecommunication sector, compared to the rest providers of other goods and services. For example, a 2014 study compared the tax burden of the mobile industry with the general sales and use tax in the United States (see Box 2).

Different tax burdens are related to the number of sector-specific taxes that are imposed on the telecommunication industry. In section 7.1, a cross-sector analysis, comparing tax burden of telecommunication operators with the tourism and media industries provides additional evidence in this regard.

---

67 One should recognize that, in order to reduce transport costs, global Internet players also tend to deploy data centers around the world.

68 See detailed analysis in section 4.3.

69 Katz, R. (2015). *El eco-sistema digital y el desarrollo industrial de America Latina*, Madrid: Ariel.

70 Including Claro, Entel Chile, Millicom, Oi Brasil, Personal (Argentina), Telefonica, TIM Brasil, and others.

71 This includes Alcatel-Lucent, Cisco, Ericsson, and Huawei.

Box 2. Tax burden on wireless industry in the United States

Mackey and Henchman (2014) conducted a study on the difference between the local, state, and federal wireless tax rate in the United States and the general sales and use taxes. According to their study, sixteen states in the US have a wireless tax burden over 5 percentage points higher than the general sales tax rate.

Disparity between wireless tax and fee rate and sales tax rate (July 2014)

Rank	State	Sales tax rate	Wireless tax rate	Wireless over/ under sales tax rate
1	Nebraska	7.00 %	18.48%	11.48%
2	Washington	9.15%	18.60%	9.45%
3	Florida	7.25%	16.55%	9.30%
4	New York	8.44%	17.74%	9.30%
5	Alaska	2.50%	11.77%	9.27%
6	New Hampshire	0.00%	8.17%	8.17%
7	Rhode Island	7.00%	14.58%	7.58%
8	Pennsylvania	7.00%	14.05%	7.05%
9	South Dakota	6.00%	13.02%	7.02%
10	Illinois	8.88%	15.81%	6.94%
11	Missouri	8.08%	14.58%	6.50%
12	Maryland	6.00%	12.37%	6.37%
13	Delaware	0.00%	6.23%	6.23%
14	Montana	0.00%	6.00%	6.00%
15	District of Columbia	5.75%	11.56%	5.81%
16	Utah	6.80%	12.53%	5.73%

According to this research, Nebraska is the only state that has a disparity of greater than 10 percentage points between its wireless rate and the general sales tax rate. Other states with large disparities include Washington State, Florida, New York, and Alaska. On the other hand, New Hampshire ranks 6th in the disparity between wireless taxes and sales taxes, despite having a relatively low rate on wireless service. This is because this state does not have a sales tax, while it imposes a 7 per cent communications tax and a USD 0.57 monthly 911 fee on wireless service. Two other states that impose taxes on wireless service but do not have sales taxes – Delaware and Montana – also rank relatively high on the scale.

4.2 Double taxation for international telecommunication services

Double taxation is defined as the collection of comparable taxes by two states on the same entity for the same income, asset, or transaction. As expected, double taxation has a negative effect on international trade and cross-border movement of factors of production. International agreements have the objective of minimizing the noxious effects of double taxation.

This section focuses on two double taxation distortionary cases in international communications: international mobile roaming, and international long distance calling. These two cases are considered as "juridical double taxation", which occurs when one person or company is subject to tax on the same income, asset, or transaction by more than one tax authority72.

4.2.1 International Mobile Roaming

Double taxation in mobile roaming increases the price of calls, thereby reducing demand. A mobile user traveling outside the country of residence where he or she has the service subscription will make calls home by relying on international roaming agreements signed up by operators in both countries. The subscriber pays a retail price based on the call volume to his home operator for the roaming service but does not pay a fee in the visiting country. In turn, the operator in the home country pays the operator in the visiting country wholesale charges based on roaming call volumes.

Double taxation emerges in setting up the price for the roaming mobile call. When the subscriber pays for roaming calls it includes in the payment the retail price of the home operator plus VAT. However, when the home operator sets up the price for international roaming calls, it includes, in addition to its own costs, the cost of the international transport service, and the price set up by the operator in the visiting country, which also includes a VAT (plus, potentially, other taxes such as withholding taxes, and local and provincial taxes). Thus, the subscriber ends up paying VAT in the home country and in the visiting country. Since VAT can range from 7 per cent to 27 per cent, retail prices increase substantially, further dampening demand. Double taxation in international mobile roaming could result in up to 40 per cent increase in the final retail price. Double taxation in international roaming is quite pervasive. For example, it is estimated that 72 per cent of roaming routes in Latin America are subject to double taxation73.

Double taxation of mobile roaming services has triggered three reactions. First, a number of regional bodies are intent in dealing with this issue in order to lower international roaming prices. For example, as part of the European Union programme to create a single market for telecommunications, the institution adopted a new law that foresees the end of roaming charges within the EU by June 201774. Similarly, the Gulf Cooperation Council (GCC) Ministerial Committee for Post, Telecommunications and Information Technology approved in 2015 new roaming price caps which will gradually reduce roaming charges at the wholesale and retail level for voice, SMS and mobile data within GCC Member States starting in April 201675. The purpose of double taxation agreements is to protect against the risk of double imposition, and protect each government taxing rights, while providing a framework for enforcement and dispute resolution76.

Secondly, in addition to regional frameworks, many countries have moved to negotiate bilateral roaming agreements. As example, Malaysia, Australia, New Zealand and Singapore have been working at reducing mobile roaming rates for voice, data and video calls.

---

72 The other type of double taxation occurs when two persons are subject to tax on the same income or capital.

73 GSMA Latin America (2012). *International roaming explained*, p. 7

74 http://ec.Europa.eu/digitalagenda/en/news/one-single-telecom-market—europe ; http://ec.europa.eu/digital-agenda/en/news/new-rules-roaming-charges-and-open-internet

75 See: https://www.tra.gov.om/news-5/1361-reduced-gcc-mobile-roaming-rates-starting-from-april-2016

76 See DePasquale, P. and Varley, A. (2011). *Telecommunications and methods for avoiding double taxation*. Presentation at ITU Workshop on "Taxation of Telecommunication Services and Related Products "Geneva, September 2 (www.itu.int/ITU-T/worksem/taxation/201109/index.html). See ITU/BDT Publication on "A Practical Guide on Benchmarking Telecommunications Prices". Available at www.itu.int/en/ITU-D/Regulatory-Market/Pages/Studies.aspx

The third approach is less focused on signing agreements and embodies strategic moves on the part of mobile operators. In industrial organization terms, double taxation in mobile roaming is the equivalent of uncoordinated "double marginalization" where the final retail price is a function of different firms in the same industry that have their respective market powers but at different vertical levels in the supply chain, applying their own markups in prices. Due to these markups, a deadweight loss is induced, thus making it worse off for the whole market. One way of avoiding the losses due to double marginalization is to merge the two firms, thus reducing at least one of the dead weight losses. This can be done through acquisition of one of the firms by the other firm in the supply chain. Obviously, this is not the primary driver for conducting a horizontal merger of two wireless operators; the main reasons remain achieving operational synergies, leveraging skills and product scope, and gaining market access. However, when a wireless carrier has a position in two countries with intense roaming traffic, they might eliminate roaming charges for their own customers in order to build competitive differentiation. The Celtel launch of "One Network" in East Africa, enabling its subscribers to roam seamlessly across 15 African countries at local rates is such an example. India's Bharti Airtel has also introduced the "one network" framework integrating India, Bangladesh, and Sri Lanka77, and America Movil has eliminated its roaming charges for postpaid customers calling among its Central American mobile networks78. In sum, this third approach demonstrates that if governments do not find a solution to deal with a portion of the distortion by agreeing to reduce double taxation in international mobile roaming, this natural economic inefficiency is being dealt with through cross-border horizontal integration of operators.

4.2.2 International long-distance calling

Double taxation can also occur in the case of international long-distance calling. The cost components of an international call include originating rates (charged by the operator in the country where the call originates) and terminating charges (imposed by the operator where the call is directed to). These are added to a margin so the originating operator can determine its retail price.

Double taxation in this case works in the following way. The operator in the terminating country includes in the termination price the tax it pays on the call to the authorities of the country where it provides the service. The terminating rate, including the operating costs and margin plus the tax, is passed in full to the originating operator. The originating operator in turn includes the termination price (which includes the tax) in the retail price that the consumer pays for the outgoing international call. In sum, taxes are paid at originating and terminating point increasing the price of the service to the point that it reduces demand. At a lower demand level, tax revenue diminishes. This situation has been reported to be the case in several countries79.

The International Telecommunication Union has been putting forward initiatives to deal with this distortion. The "Melbourne Agreement" adopted in 1988 with the World Administrative Telegraph and Telephone Conference proposed that taxes should only be collected "in respect of international services billed to customers" in the country of origination. More recently, this was addressed in the ITU International Telecommunication Regulations (ITR) that was reviewed during the World Conference on International Telecommunications (WCIT) held in Dubai, United Arab Emirates from 3-14 December 2012. The ITRs serve as the binding global treaty designed to facilitate international interconnection and interoperability of information and communication services as well as to ensure their efficiency and widespread public usefulness and availability. The ITRs state in Article 8.3 that "*Where, in accordance with the national law of a country, a fiscal tax is levied on collection charges for international telecommunication services, this tax shall normally be collected only in respect of international services billed to customers in that country, unless other arrangements are made to meet special circumstances*"80.,

---

77 Telegeography (2012). Airtel links Africa and South Asia with One Network.

78 Economía y Negocios (2014). Claro elimina cobro por roaming y llamadas a Centroamérica. April, 21, 2015.

79 Cave, M. (2013) *Taxing telecommunication/ICT services: an overview.* Geneva: ITU, p. 24

80 WCIT, ITR review, at: www.itu.int/en/wcit-12/Pages/default.aspx

This effect, which is also akin to a double margin81 process, is not only detrimental to international call demand and, consequently, tax revenues. It has set the stage for the emergence of VoIP carriers, such as Skype. By eliminating the originating operator (since the call is originated by a device connected to a broadband network), a Skype-to-phone call avoids the originating cost, including only as an input the terminating price. Furthermore, since the purchasing of service is conducted outside the boundaries of the originating country, the consumer originating the call does not pay local taxes on the call. This allows Skype to price an international call at an average of USD 0.02 per minute, well below the rate implied by the terminating costs and the double taxation regime. The distortion implied by double taxation of international calls can only be dealt with if the governments in the territories where the call originates and terminates agree to eliminate the tax on one of the "sides" of the international call, this is treated in the ITRs Article 8 on charging and accounting82.

4.3 Taxation regimes of global players with no local presence

The discussion above of tax rules for players operating in the digital space (see section 2.4) becomes quite complex for global players. The following section presents a series of case studies of specific global digital companies, assessing how they deal with taxation issues and what the net impact of these arrangements are in terms of tax collections for host country governments.

4.3.1 Netflix

The US-based company Netflix has a total 53 million worldwide subscribers (3Q2014), of which 66 per cent are located outside the United States. Netflix offers video streaming service in Europe (Austria, Belgium, France, Germany, Luxembourg, Netherlands, Scandinavia, Switzerland, United Kingdom), Latin America and the Caribbean (Argentina, Brazil, Paraguay, Uruguay, Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela, Mexico, and Ecuador), and Asia (Australia). The larger concentrations of subscribers by country are presented in Table 8.

The company objective is to generate 80 per cent of revenues from international subscribers, which compels it to aggressively expand in all continents. In its ongoing international expansion, the company is facing some taxation challenges, based on complaints of unfair competition on the part of local streaming providers and cable operators.

For example, the city of Buenos Aires imposed a 3 per cent gross income tax on all foreign online subscription services, including video, music and games. The tax, known as the "Netflix tax", is targeted directly at streaming services and relies on credit card companies acting as tax withholding agents. Rather than taxing consumers, the objective is to collect taxes from digital content distributors that do not pay any corporate taxes in Argentina83. Beyond Netflix, the measure also affects services such as Amazon Instant Video, Spotify, and iTunes. The argument in support of the ruling is to protect local streaming services that do pay income taxes in Argentina. The law also stipulates that the tax cannot be passed through to consumers84.

In Europe, Netflix chose to headquarter in the Netherlands not to deal with the culture tax levied on French TV and media enterprises. As mentioned above, this prompted opposition from local cable TV providers arguing that this situation creates unfair advantage for the US-based company, since French video streaming providers pay 19.6 per cent VAT. In response, the France Government introduced a 2 per cent tax on foreign video on demand operators. Starting in January 2015, international online video streaming services were liable for payment. The measure was prompted by the French film

[81] Cave, M. (2013) ITU paper on *Taxing telecommunication/ICT services: an overview.* Geneva: ITU, p. 35.

[82] See Article 8 on charging and accounting of ITRs agreed upon at WCIT in Dubai, United Arab Emirates, 3-14 December 2012.

[83] Mango, A. (2014). "Buenos Aires Issues 'Netflix Tax' on Streaming Media Subscriptions". Retrieved in www.hollywoodreporter.com/news/buenos-aires-issues-netflix-tax-729994

[84] Ferdeline, A. (2014). Argentina's "Netflix tax" isn't surprising. Blogs. London School of Economics.

Table 8: Netflix: Paying subscriber base ('000) (2Q2014)

Country	Subscribers
United States	35 085
United Kingdom	4 452
Canada	3 000
Sweden	940
Mexico	640
Netherlands	600
Brazil	560
Denmark	440
Norway	390
Finland	370
Colombia	310
Argentina	310
Ireland	260
Chile	155

Source: Netflix

producers association and local video streaming services motivated by the lack of local tax payments by foreign providers, but also fears that Netflix would affect French "cultural exception"85.

In Canada, large telecommunication operators, such as Bell Canada and Rogers, are also calling for a similar tax to be levied on all streaming services. The argument in this case is that since Netflix does not follow Canadian local content laws, it puts local companies at a disadvantage86.

4.3.2 Facebook

The OECD has extensively studied the issue of corporate taxation of Internet advertisers87. The following section will review a typical tax planning structure of digital advertisers and use Facebook as an example of their impact on countries with emerging market economies.

Facebook provides social network functionality, access to applications, and messaging capability to consumers free of charge. However, by virtue of two-sided market dynamics, the supplier collects advertising revenues driven by its enhanced capability to target consumers based on their preferences and demographic characteristics. As of 2014, Facebook global revenues would have reached USD 8.7 billion with a 25.9 per cent margin (see Table 9).

85 Chazan, D. (2014). Netflix Is Getting A Frosty Reception In France. *The Telegraph*, September, 15; Nigmatulina, K. "France introduces new tax on VoD operators based abroad". *HIS Technology.*

86 "Canada And Buenos Aires Move To Tax Netflix". *The Hollywood Reporter.*

87 OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. OECD/g20 Base Erosion and Profit Shifting Project, OECD Publishing.

Table 9: Facebook: Revenues and margin from advertising and transactions

Year	Monthly active users (million)	Revenues (in billion USD)	Profitability (in billion USD)	Margin
2006	12	4.33	---	---
2007	50	3.00	-2.70	---
2008	150	1.81	-0.37	---
2009	360	2.15	0.70	32.6 %
2010	608	3.29	1.01	30.7 %
2011	845	4.39	1.18	26.9 %
2012	1 056	4.81	0.05	0.1 %
2013	1 228	6.41	1.22	19.0 %
2014 (*)	1 320	8.70	2.26	25.9 %

(*) Nine months annualized

Sources: Carlson (2011); Tsotis (2011); Wikipedia (2011); Annual Report; analysis by the author

These financial results are generated on the basis of leveraging 1 320 million monthly active users, which result in average revenues of USD 6.59 per subscriber. That said, revenues per subscriber are much higher in North America than in the rest of the world because this geography is much more digital advertising intensive than the rest of the world (see Table 10).

Table 10: Facebook: Monthly users and revenues per user

Year	North America		Rest of World (*)	
	Monthly active users (million)	Revenues per user (in USD)	Monthly active users (million)	Revenues per user (in USD)
2009	112	4.62	69	---
2010	154	---	133	---
2011	179	3.16	225	0.39
2012	193	4.04	304	0.54
2013	201	6.00	376	0.82
2014 (e)	206	6.45	---	0.86

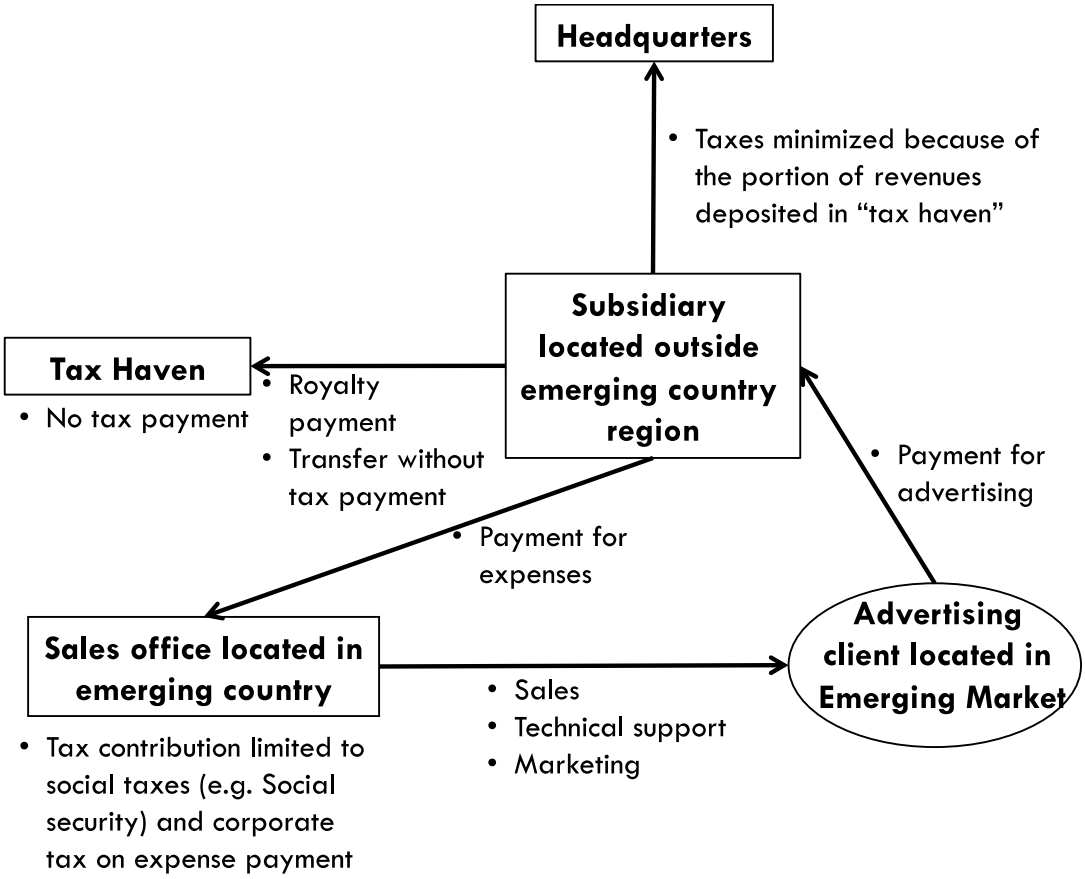
(*) Includes Africa, Latin America and Arab States

Sources: Facebook S-1; Facebook Annual reports; Statista

The company is headquartered in the United States, where it has all research and development staff focused on enhancing the power of consumer targeting and advertising efficacy, and an important local business, for which it pays corresponding corporate taxes. The physical presence in a typical country with an emerging market economy is relatively small, primarily focused on selling advertising, and potentially training local advertisers to use the platform. However, contracts with local advertisers from the emerging market are concluded electronically through remotely located websites on the basis of standard agreements. Payments for advertising contracts are not logged in the local subsidiary but in remote locations, either headquarters or another subsidiary. Thus, most revenues resulting

from sales of advertising to local firms in countries with emerging market economies are treated as revenues in headquarters or the remotely located subsidiary. On the other hand, countries with emerging market economies do not tax the profits of the local subsidiary because the latter does not have income that is attributable locally88. The only taxes paid locally comprise social security for local employees and a corporate tax on the payment received for services rendered to headquarters (see Figure 9).

Figure 9: Facebook: Flow of funds and tax implications



Source: Adapted from OECD (2014). Addressing the Tax Challenges of the Digital Economy. Paris, pp. 186-191.

Based on this approach and according to reports in the press, despite earning an estimated GBP 223 million in the United Kingdom in 2012, the company paid no taxes89. The situation in a country with an emerging market economy is fairly similar. For example, a pro forma financial statement of a small local Facebook operation could be extremely profitable (see Table 11).

This country with emerging market economy has a total of 24 million monthly active users, from which advertising revenues are collected at a ratio of USD 0.86 per user. The operating expenses of this subsidiary comprise the salaries of 40 professionals with an assumed fully loaded salary of USD 70 000 each. The location has no debt or corporate tax obligations (except for expenses payment booked as income). The only additional taxation incurred by the local subsidiary is related to social charges resulting from payment of the local staff, and a corporation tax for payment received for services performed to headquarters. This situation yields an extremely profitable pro-forma operation (net margin: 80%). The situation could be different in some emerging market countries like Chile

88 OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. Paris, pp. 186-191.

89 Garside, J. (2013) "Facebook caught in controversy over earnings exported to Cayman Islands". *The Guardian*, December 5. Additional data in OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. Paris, pp. 186-191.

Table 11: Facebook pro forma income statement (typical emerging market) (2014)

Metric		Source
REVENUES		
• Monthly active users	24 000 000	
• Revenues per MAU (ROW adjusted)	USD 0.86	Estimate based on Annual Report
• Total	USD 20 640 000	
OPERATING EXPENSES		
• Staff (marketing, sales, administration)	40	Estimated based on staffing of a typical office
• Average yearly salary (fully loaded)	USD 70 000	Fully loaded salaries
• Total	USD 2 800 000	
GROSS INCOME	USD 17 840 000	
• Interest	USD 0	Annual Report
• Corporate taxes	USD 535 000	Corporate tax on gross profits
• Social contributions	USD 896 000	32% rate
NET INCOME	USD 16 400 000	
• Net margin	80%	

Source: Analysis based on typical MAUs and staff in a small country with emerging market economy

where digital advertisers are withheld a 35 per cent tax by advertisers at the time an invoice is paid to the operator.

4.3.3 Google

The approach followed by Google in most countries when it comes to tax strategy is similar to that of Facebook. In addition to a fairly centralized processing operation, the search and advertising firm deploys offices around the world with staff in charge of selling advertising and providing technical consulting to its customers. Given its highly centralized operating model, the staff deployed overseas represents a small portion of the operator personnel. For example, in 2013, Google had 47 756 employees worldwide. Of this amount, it is estimated that, for example, the Latin America headcount did not exceed 400 staff90.

The staff in local offices is responsible for selling advertising to local customers. However, the sales are not logged locally but remotely in subsidiaries such as Google Ireland. Following the "permanent establishment" rule, the operator does not pay taxes in the local country where the acquisition of digital ads is conducted. The rationale is that the sale actually occurs in the remote subsidiary where the purchasing is logged. Furthermore, since the purchasing is handled through auction pricing, it is not the local staff that actually performs the sale but the customer himself91.

The remote subsidiary, such as Google Ireland does not necessarily pay taxes at the local 12.5 per cent rate, since the revenues received from customers located in each country are transferred to

[90] In France, the company employs approximately 500 staff. See Schechner, S. "Google's Tax setup Faces French Challenge", *Wall Street Journal* (October 8, 2014).

[91] See OECD (2014). Addressing the Tax Challenges of the Digital Economy. Paris, pp. 188-191.

a subsidiary in the Netherlands in the form of royalty fees for intellectual property, which in turn transfers it to an Irish unit registered in Bermuda, a location with no corporate income tax. The resulting arrangement minimizes the income tax to be paid by the local office. As an example, in 2012, Google revenues from France, Germany, and the United Kingdom were estimated at approximately USD 9 billion generated by digital advertising sold to local customers. Of this amount, the three country subsidiaries reported USD 1.28 billion in revenues and USD 33 million in income tax. In some Google subsidiaries, the revenues result from programming contracts arranged with Google headquarters. For example, the France subsidiary performs programming work for the Chrome browser for Apple Inc.'s iOS. Additionally, the subsidiary is paid by the Ireland subsidiary for marketing promotion services for the selling of digital advertising92.

At an aggregate level, the report submitted by Google in 2012 to the Securities and Exchange Commission of the United States reported that, from gross revenues of USD 7 600 million generated outside the home country, the company paid foreign taxes of USD 248 million, an effective tax rate of 3.26 per cent. This is not the case in the United States, where the tax rate amounts to 49.81 per cent (this amount could be somewhat distorted from payments of deferred taxes). Given the high rate incurred in the home country, Google's incentive is to keep as long as possible foreign earnings from being transferred to the United States. Thus, the report informed that Google kept approximately USDD 21.2 billion in cash balances outside the home country93.

In Latin America, it is estimated that Google revenues approximated USD 3.1 billion94. According to public communications, its Brazil subsidiary, which is Google's largest in the region, paid approximately USD 310 million in taxes in 2013. If we add the rest of Latin America, for which the local subsidiaries are paid a service fee, and that each employee is compensated at USD 70 000 per year, local taxes to be paid would comprise social security contributions (averaged at 31.80 per cent rate) and a 3 per cent tax for gross revenues, total taxes would reach USD 541 million. This would amount to an effective tax rate of 18 per cent95.

4.3.4 Amazon

Originally a book distributor, Amazon has been progressively expanding into content development, devices, and hosting services (see Table 12).

Amazon's original competitive advantage relied on no-fixed costs as a result of not owning a store network, the variety (long tail) of goods offered derived from low inventory costs, and lower prices, which meant higher margins. The extension from books into music and merchandise represented a horizontal scope expansion, remaining close to the core business. The launch of Amazon marketplaces, positioned the company as a two-sided platform, which enhanced the supplier product scope without holding inventory (other retailers could offer their products through the Amazon channel). At 6-15 per cent margin in its *Marketplaces* platform, Amazon captures higher profits than with its own products, while providing real time data on high potential products. In fact, Amazon Marketplace represents an entry into an adjacent value chain (two sided platforms), leveraging original capabilities. In its next diversification move, Amazon entered into web services by offering a broad set of global compute, storage, database, analytics, application and deployment services. In doing so, Amazon Web Services resells the platform originally developed for the company's own offering, achieving higher returns to scale by incorporating additional volume. However, while connected to the original scope, the diversification is further away from the core. The entry into the device business, by offering the Kindle e-reader is motivated by the need to solidify the relationship with buyers (e.g. Kindle owners report buying in seven or more Amazon

92 Schechner, S. "How Google's French Tax structure works", *Wall Street Journal* (October 8, 2014).

93 Jiménez, M. (2012). "Google, Apple y Microsoft pagan impuestos mínimos fuera de EE.UU." *El País*, 30 de enero.

94 Google worldwide revenues in 2014 reached USD 66 billion, of which USD 31.38 billion originate in what the company considers to be "rest of the world', which means global revenues minus the United States and the United Kingdom. On the other hand, PWC estimates that search revenues in Latin America for the top seven countries are USD 1,805 million. By grossing up to include the remaining countries, and adjusting for other Google businesses, total revenues are estimated to reach USD 3 050 million.

95 Katz, R. (2015). Op.cit., p. 195.

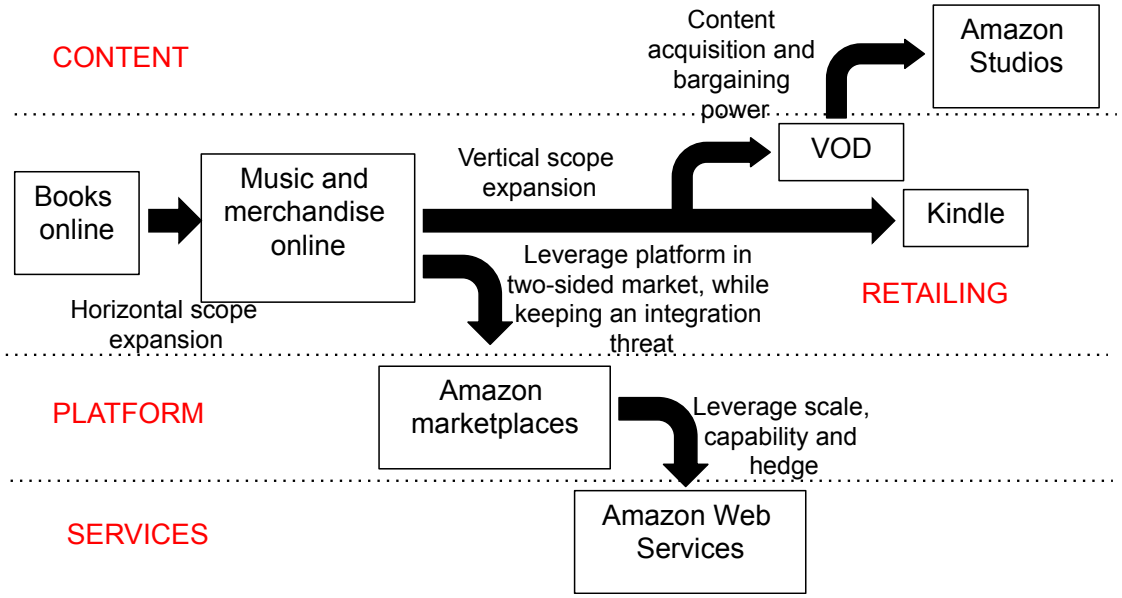
Table 12: Amazon: Diversification schedule

Year	Initiative	Description
1995	Book distribution	Selling books online
1999	Expansion into music, electronics, etc.	Selling other merchandise online
2000	Amazon marketplaces	Third party merchant platform
2002	Amazon Web Services	Cloud computing services
2006	Video-on-demand	Video streaming
2007	Kindle	Shop and download books and movies
2011	Amazon Studios	Production of original video content
2011	AdNetwork search	Targeted advertising to Amazon customers
2012	UpNext	3D mapping company

Source: ITU

The diversification strategy indicates a progressive move away from the core books online business (see Figure 10).

Figure 10: Amazon: Diversification strategy



Source: ITU

departments, while non-device owners shop at 5.5 departments). Nevertheless, the Kindle strategy appeared to be a defensive move to reinforce the core business. As a next diversification step, Amazon entered into video-streaming and content production. This move appears to be a logical extension from selling DVDs once the physical format began to be superseded by downloads. Further, the entry into production was primarily motivated by the need to acquire an independent content source and increase its bargaining power with the studios (a move similar to Netflix).

As the diversification strategy indicates, Amazon is positioned in multiple different businesses, ranging from e-commerce to video streaming, with a strong international presence (see Table 13).

Table 13: Amazon revenues (USD millions) (4Q2013)

	North America	International	Total
Electronic and General Merchandise	10 648	6 478	17 216
AWS, Advertising and co-branded credit cards	1 170	64	1 234
Media (books, music, movies, videogames, software, and digital downloads)	3 513	3 714	7 227
Total	15 331	10 256	25 587

Source: Annual report

As Table 13 indicates, 40 per cent of total sales are generated internationally. However, each line of business has different tax implications. In the case of e-commerce, Amazon's tax planning structure has similarities with Facebook. As a starting point, the central organization in the United States is focused, in addition to managing the US business, on developing the IT platforms for data management and fulfilment, coordinating procurement to achieve scale, and maintaining consistency. These coordination services are sold to overseas regional operating subsidiaries for a management fee. In addition, all the rights for the intellectual capital underlying the delivery of services are held by the central organization. Overseas subsidiaries share in the development costs by providing a payment for the rights.

Purchases from overseas customers are handled by the regional subsidiaries, which have similar platforms for processing orders and payments. Fulfilment is handled by the country unit where the customer has made the purchase. However, since this unit provides only routine services, they are allocated minimal taxable income. In fact, all revenues derived from the sale in a country are booked at the regional subsidiary level, which means that the country where the sale took place does not tax the profits originated at that transaction. Furthermore, the regional subsidiary where the sale is booked tends to be located in countries that have preferential treatment for income derived from certain intangibles, which results in a lower tax rate. Finally, all payments that the regional subsidiary makes to central headquarters are not taxed because they are subject to double tax treatment. All in all, Amazon implemented a tax structure that minimizes its tax contribution overseas96.

4.3.5 Spotify

In 2013, Spotify, the music streaming site, reported revenues of USD 931 million (91 per cent of which came from premium users and 9 per cent from advertising). The company has 12.5 million paying subscribers (of a 50 million total base)97. About 70 per cent of its revenues are paid to rights holders. The company is essentially a multi-sided platform collecting revenues from advertisers and premium subscribers (over a "freemium model"). In that sense, its taxation exposure is a function of two businesses: digital advertising and distribution of digital goods (similar to Netflix).

As the company expands globally, it appears to be shifting its tax strategy to minimize taxes. For example, financial results in 2012 for its United Kingdom subsidiary indicated a loss after taxation of GBP 10.1 million (over revenues of GBP 87.9 million). In the middle of that year, the company shifted the revenue recognition of all of its global premium subscriptions outside the UK (4 million in 2012)

[96] OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. Paris, pp. 182-186.

[97] The site is available in 58 markets around the world – Andorra, Argentina, Austria, Australia, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hong Kong (China), Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Monaco, New Zealand, Netherlands, Nicaragua, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Singapore, Slovakia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Uruguay and USA.

from the United Kingdom subsidiary to other local subsidiaries. The move appears to be driven by an attempt to minimize the tax burden otherwise imposed in the United Kingdom98.

Spotify adds national, state and local taxes to its consumer bill when its entry in certain geography implies investing in marketing and promotional activities and use of local sales agents and consultants. In an approach similar to Netflix, Spotify is facing a number of cases where governments are attempting to tax its income. In addition to the governments of the city of Buenos Aires and France, the state of New York is considering imposing a tax on digital goods, which could affect Spotify, as well as Pandora and other streaming services. The rationale behind the proposal is that digital music should be considered tangible personal property.

4.4 Tax optimization approaches

The common approach observed in the prior case studies indicates that, in order to reduce tax liabilities, global players tend to segregate taxable income from the activities that generate it. Three approaches to reduce taxation have been identified:

1. Avoid a taxable presence in certain markets by shifting gross profits from the market where the good is being offered to subsidiaries located in tax havens or low tax environments.
2. Keep withholding tax low or nil at the source, by shifting profits in the form of royalties or interest to a lower tax jurisdiction.
3. Avoid taxation of low-tax profits at the level of the parent by searching for preferential domestic tax regimes.

In addition, global digital players tend to minimize the amount of VAT by optimizing its global deployment in search for low rates.

In all fairness, these approaches have been implemented by multinational corporations for a long period of time. Perhaps, the aggravating factor is that digitization enables more flexible arrangements with regards to tax optimization than manufacturing and distribution of physical goods.

In dealing with this situation, governments need to consider three trade-offs. The first issue when assessing this approach is how to assess from a cost/benefit standpoint the fact that the resulting low taxation enhances adoption of digital goods and services (with its corresponding spillovers) against the fact that by shifting liabilities away from income producing locations, other taxpayers need to bear the burden. The second issue to deal with is unfair competition. Local digital players paying the corresponding taxes based on their location have to compete with global players offering the service at an economic advantage (the prominent argument in the Netflix case). The third issue to consider is taxation asymmetry with regards to other firms of the digital eco-system99.

5 Issues regarding tax collection in the digital sector

The issue of cost of tax collection has been studied and even considered in the telecommunication sector for a number of years100. Among the cost of collecting taxes in telecommunications, several concerns have been raised. For example, levying telecommunication taxes in non-monetary economies, such as those prevalent in rural areas of emerging market countries, presents obvious difficulties. More complex effects could arise when taxes act as an incentive to avoid payment and

---

98 Dredge, S. (2014). "Spotify revenues grew sharply in 2013, but operating losses also rose". *The Guardian*, November 25, 2014.

99 See section 4.1.2.

100 Cave, M. *Taxing telecommunication/ICT services: an overview www.itu.int/pub/D-PREF-EF/en*

push companies to operate in an informal economy. These concerns still exist and become part of a larger set of problems in the case of the digital economy. The purpose of this chapter is to present some of the problems confronted by policy makers in developing an effective tax system to tackle the current digital sector.

5.1 Obstacles to effective tax collection

In general terms, an effective tax system requires good information from taxpayers to determine who has to pay and how much. The limited availability of information on who has consumed a specific digital good or service becomes an obstacle to collect taxes in an effective manner. Globalization exacerbates this problem insofar that it is difficult to locate information of who are the consumers that have purchased a good stored in a server beyond the frontiers of a given country. A classic example of this situation has been the problems encountered in implementing the "Netflix tax" in Buenos Aires, Argentina. As mentioned above, the objective of the city government was to collect taxes on subscriptions or payments for the purchasing of digital goods such as a movie, a song, or other digital content (except for software) from operators such as Netflix, Apple TV, or Spotify101. Since none of these players have an operation in Argentina with servers capturing information on subscribers, the government was confronted with the difficulty of collecting information for administering the tax collection activities. The solution devised was to rely on credit card issuers. Considering that the purchasing of subscriptions for these services are paid through credit cards, the government decided to make these companies the key point of information gathering. This remained a critical issue since, considering that the tax was only applicable to residents of the city of Buenos Aires, the government needed to gain access to records stating the subscriber address.

While this option solved the information-gathering hurdle, it did not address the tax collection obstacle. In the purchase of a physical good, collecting sales taxes becomes the responsibility of the place at which the good is acquired. In this case, again, the provider of the service is located beyond the frontiers of Argentina. This meant that a system dependent on Netflix and other providers collecting taxes and then remitting the levy to the Buenos Aires was not cost effective. In this situation, the city government opted to rely again on credit card issuers. In this case, when a consumer pays for a subscription on his or her credit card, the digital operator collects the tax and then proceeds to deliver the amount collected to the city government. This approach addressed the collection barrier. However, it raised another problem related to consumer privacy. Some consumer advocates argued that collecting, storing and delivering information of private citizens' purchases of a digital good became an infringement of their privacy102.

To deal with digital good VAT collection according to the location where the good is purchased, the EU set up a mini one-stop-shop portal where taxes are filed and paid at this single European point from where authorities of member states redistribute the amounts to the right country. In order to identify the country of residence, companies can rely on either the IP address and the location of the consumer's computer, or the address of the credit card used to purchase the subscription103.

Notwithstanding the problems raised by relying on credit card issuers for tax collection of digital goods, the cases reviewed above are emblematic of the potential contribution that financial services players could make to address the issue of tax collection.

5.2 The case of evasion and fraud

Tax evasion and avoidance is directly related to the ease or difficulty with which taxes can be collected. While taxes collected from telecommunication operators are relatively easy to collect, that is not the case for users of digital goods and services.

---

[101] "Desde febrero aplicaran el Nuevo "impuesto Netflix", *Clarín* (December 19, 2014).
[102] Clarín (2014). Desde febrero aplicaran el nuevo "impuesto netflix".
[103] Nigmatulina, K. (2014). "France introduces new tax on VoD operators based abroad". *HIS Market Insight*.

Tax evasion in the digital sector has multiple dimensions. On the supply side, a number of digital start-ups tend to operate in an informal context, thus avoiding payment of taxes. On the consumer side, digital piracy results in significant tax revenue losses. By illegally downloading digital content, consumers do not pay sales taxes104. On the other hand, it is argued that it is precisely taxation of digital goods that indirectly promotes the illegal acquisition or piracy of those items. The increased price of digital goods, which would result from the new tax, encourages consumers to look for lower-priced or untaxed items offered by digital pirates.

This last issue raises a fundamental point in the design of tax policy: what is an optimal tax structure in an economy where evasion exists? Richter and Broadway (2001) argue that efficient tax design needs to consider the ease with which taxes can be evaded105. Along these lines, the authors argue that efficient taxation must take into account the incremental effects each type of tax has on the cost of distortions and the cost of risk taking on the part of consumers. In the case of taxes associated to the consumption of digital goods, when evasion is fairly easy and risk is low, the design of an efficient tax system could be challenging. This was recognized by the Australia Government in its assessment of online copyright infringement106.

Smuggling of digital devices is another classical way of avoiding payment of import duties and potentially, sales taxes.

5.3 Informal digital economy and grey markets

Going back to the cost of taxation, the least expensive and most efficient way to collect taxes is to focus on imposing levies on large corporations, such as telecommunication operators. These firms have developed billing systems and therefore, state-of-the art capability for tracking information and collecting taxes. Furthermore, no large corporation wants to be exposed to a reputational conflict over tax avoidance, which means that they would be very willing to carefully follow all government directives regarding payments.

In a digital economy, however, the emergence of a multiplicity of small and medium firms offering Internet-based services (electronic commerce, social networking, matching platforms, etc.) leads to the emergence of an informal economy where the government faces more difficulties in collecting taxes.

It is unclear how startups that proceed to escalate and grow in size would easily convert to complying with all tax requirements107. If the informal sector of the economy represents around 50 per cent of the GDP108, as is the case in many countries in the world of emerging market economies, tax revenues coming from small digital operators tends to be limited.

6 Economic impact of taxation on the performance of the digital economy

So far, the analysis has focused on different approaches to taxation followed by countries around the world, as well as strategies followed by some global players to minimize their tax burden. As mentioned above, taxes on service providers and consumers of digital services could have an economic impact

---

104 It is estimated that the global software piracy rate is 42%, and range from 86% in Indonesia to 19% in the United States (source: Business Software Alliance (2012). *Shadow Market*. Washington (May).

105 Richter, W. and Broadway, R. *Trading off tax distortion and tax evasion*. CESifo Working paper No. 505. June 2001.

106 Australian Government (2014). *Online copyright infringement*. Discussion Paper.

107 See Farrell, D. "Tackling the Informal Economy". *Business Week*.

108 It is estimated that the informal sector in Latin America ranges from 32% of GDP in Chile to 71% in Bolivia. See Tokman, V. (2009). "The informal economy, Insecurity and Social Cohesion in Latin America", *International Labor Review*, 146, pp. 81-107.

by reducing the amount of capital to be invested in the deployment of infrastructure or increasing the total cost of ownership of digital devices for consumers. This section will present research that assesses the potential impact that taxation can have in these two domains. It will provide also a perspective on the issue of whether a potential elimination of specific taxes could have an economic impact that outweighs the cost of foregoing the levy.

6.1 Impact of taxation on telecommunication capital investment

As mentioned in chapter 1, the research literature to date provides evidence that taxes tend to raise the required pre-tax rate of return of capital invested. In general terms, leaving aside the positive effects taxes play in terms of their contribution to the delivery of public services, they tend to also affect the incentives of a company to make investments and reduce the supply of funds available to finance them. In industries such as telecommunications that provide broadband services, a critical platform to deliver information, public services, and ensure economic growth, taxation tends to reduce the level of capital investment.

In a study on the impact of state and local taxes on the purchasing of broadband investment by telecommunication service providers and cable TV operators in the United States[109], an econometric model tested the impact of sales taxes on telecommunication and cable TV investment (see Annex A). Considering that the telecommunication and cable TV industries enjoy different tax exemptions by state in the US, and that changes in the tax regime affect each industry differently, the model was specified for the telecommunication and cable TV industries separately.

As the models indicate, the investment in telecommunications is sensitive to sales taxes; every decrease of 1 per cent in the average sales tax rate results in an increase in the total cable TV per capita investment of 0.0408 per cent and 0.0332 per cent in wireline and wireless per capita investment[110]. Furthermore, considering that 30 states impose a sales tax on wireless and wireline equipment purchasing, while 31 states (plus the District of Columbia) do so on cable TV equipment, it is reasonable to consider a scenario under which these states were to join those that have enacted policies aimed at promoting network deployment by totally eliminating this tax. This scenario would result in a baseline estimate of increase in investment of USD 1.48 billion, although an optimistic scenario projects the increase to reach USD 1.72 billion (an increase of 4.08 per cent).

Research indicates that the economic benefits associated with investments in communications networks are broadly distributed across the many businesses, governments, and non-profit organizations that use information technology and communication services, as well as consumers. Those benefits comprise short-term effects resulting from network construction, and long-term effects driven by the positive externalities of communications networks, particularly broadband. By relying on input-output matrices to quantify the construction effect and econometric analysis to estimate the positive externalities, the following benefits have been estimated at a national scale. Baseline estimates indicate that an increase in investment of USD 1.48 billion, derived from an elimination of the sales tax on equipment purchasing, would:

- generate USD 7.24 billion in additional annual GDP in the first year after the increase in investment and USD 33.13 billion of output over three years;
- create 53 000 new jobs in the first year after the increase in investment and 243 000 over three years;
- increase broadband deployment by 634 000 new connections in the short term.

The sum total of the baseline economic effects is presented in Table 14.

[109] Katz, R., Flores-Roux, E., Callorda, F. (2012). *Assessment of the economic impact of taxation on communications investment in the United States*. New York: Telecom Advisory Services LLC.

[110] The elasticity coefficients in relationship with taxable investment, 66% of total investment, are 0.0619 and 0.0504.

Table 14: Economic effects of eliminating the sales tax on network equipment

Horizon	Incremental Investment (USD '000'000)	Direct Effects		Direct and Indirect Effects	
		Incremental Output (USD '000'000)	Jobs (000)	Incremental Output (USD '000'000)	Jobs (000)
Short-Term (1 year)	1.48	2.96	32	7.24	53
Long-Term (3 years)	6.77	13.54	147	33.13	243

Source: TAS analysis

Furthermore, the new economic activity would generate substantial offsetting revenues for state and local governments as new employment and economic activity generates income, sales, property, and other tax revenue for governments.

A similar analysis was conducted in 2013 by this author evaluating the impact of repealing a sales and use tax exemption on telecommunication equipment in the state of Minnesota111. The study indicated that the telecommunication industry, stimulated in part by a sales tax exemption on the purchase of equipment, had invested USD 5.167 billion between 2006 and 2012, which by virtue of the direct multipliers and spillover effects had contributed to the support of 112 239 jobs/year and generated USD 10.38 billion in output. Based on econometric modelling and the results of survey research, it was estimated that repealing the sales tax exemption would trigger a decrease in capital investment of USD 153 million over two years, and USD 722 million over the long run. Based on this analysis, the state legislature decided to extend the repeal for the foreseeable future.

6.2 Impact on ICT adoption and overall digitization

The prior case provided evidence on how taxation can affect the level of capital investment of suppliers of broadband services. The study will now turn to the impact consumption taxes could have on broadband adoption.

6.2.1 The case of broadband services

The economic structural factors driving broadband purchasing need to be assessed in terms of the total cost of ownership, a concept that allows factoring in the purchasing cost of devices, initial activation costs, as well as the recurring costs resulting from monthly service charges. Total cost of ownership is the sum of the cost of usage (service) plus part of the cost of the access device, which is assumed to be amortized throughout its lifetime, usually between two and four years, depending on the device112.

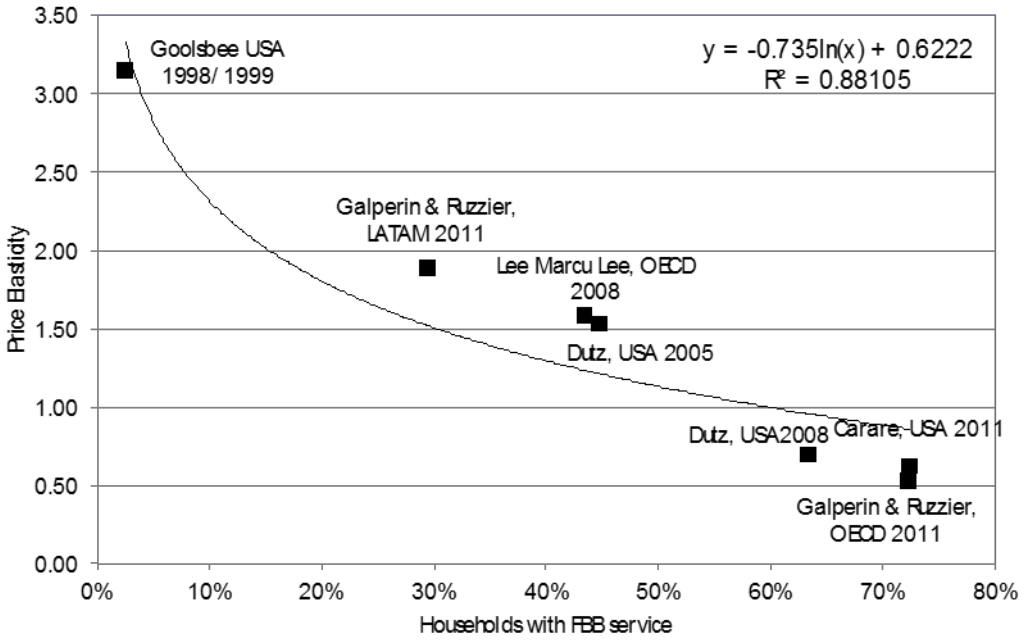
As a general principle, telecommunication services have negative elasticities: higher prices imply lower demand. However, pricing needs to be decomposed among its different elements because they affect initial adoption and usage in different manners. Initial adoption is constrained by device acquisition, its corresponding tax burden, service activation cost, and expected recurring costs derived from subscription retail fees and its taxes.

Device retail prices and their corresponding taxes vary between fixed and mobile broadband. Fixed broadband requires the acquisition of a personal computer, while mobile broadband could be supported through either a personal computer or a smartphone. Retail acquisition prices of this type of equipment are driven by supply and demand conditions, in particular manufacturing economies of

[111] Katz, R. and Callorda, F. *Assessment of the economic impact of the repeal of the tax exemption on telecommunication investment in Minnesota*. New York: Telecom Advisory Services, December 2013.

[112] The average replacement cycle of a PC is 3.5 years, while the cycle for a mobile handset is 18 months.

Figure 11: Correlation between fixed broadband penetration and price elasticity



Note: The t-value for the variable of interest is -.755

Source: Katz and Berry (2014)

scale and component costs. While device retail pricing is typically outside the realm of policy control, taxation is not. Final price of devices is affected by a set of different taxes, which vary by country and year. As will be shown below, taxes can, in some cases, add a significant burden to the retail price.

The importance of expected recurring costs on initial adoption varies by type of device. For example, in general, service subscription for a wireless modem is generally stable, representing a monthly rate for an expected type of service plan. As a result, subscribers can easily factor in the monthly subscription cost on the total cost of ownership and make an informed decision regarding adoption. In the case of smartphone access to mobile broadband service, prepaid subscription allows subscribers to purchase service while limiting total cost of ownership to a minimal amount. In this case, taxes play a more limited role than in the case of service activation and postpaid usage rates.

There are several studies that shed a light on the potential price elasticity of broadband services113. Considering the level of service adoption at the time each of these studies was completed allows estimating the relationship between fixed broadband penetration and elasticity (see figure 11).

Figure 11 plots fixed broadband household penetration and calculated elasticity at the time each of the seven studies was conducted. The data allows displaying the relationship between both indicators,

[113] For example, by relying on data from a survey of approximately 100 000 US households, Goolsbee (2006) found fixed broadband service demand between 1998 and 1999 to be fairly elastic. According to the author, for levels of penetration between 2% and 3%, price elasticity was between-2.8 and-3.5. In another study, Galperin and Ruzzier (2012) utilized data for the OECD and Latin America to estimate the elasticity of fixed broadband service in 2011. Their main finding is that the elasticity of both regions varies. In the case of Latin America, where penetration averaged 7.66% in 2011, broadband price elasticity was-1.88. In the case of the OECD, with an average broadband penetration of 27.48%, price elasticity was-0.53. This result begins to point out that, as expected, mature markets tend to be more price inelastic. Coincidentally, Lee, Marcu and Lee (2011) found that for OECD countries between 2003 and 2008, elasticity was-1.58 (lower than for Latin America). Confirming the inverse relation between penetration and elasticity, Dutz, Orszag and Willig (2009) analyzed the elasticity of broadband service in the US between 2005 and 2008. They found that in 2005 the elasticity was of-1.53 but declined to-0.69 in 2008, confirming the declining elasticity trend at higher penetration levels.

showing that higher penetration is associated with lower price elasticity. Why is this? At the beginning of a broadband diffusion process, prices are typically high, broadband is not a key technology for most users and non-adopters are very price sensitive. With increasing penetration, prices tend to fall, broadband becomes a key resource for a larger portion of the population, and consequently, elasticity declines. By relying on the data in Figure 11, a logarithmic function is specified with the purpose of estimating the coefficient that links penetration (in the X axis) with elasticity (in the Y axis). While the elasticity data in Figure 11 is presented in absolute values, the price elasticity coefficient is always negative indicating the indirect relationship between price and demand. The equation displayed in the figure indicates what the elasticity would be at each broadband penetration level.

The formula underlying the model and derived from the data in Figure 11 is the following:

Expected penetration = (1 + ((0.735 * Log (current penetration/100) + 0.622)/100) * % price change) * current penetration

Where,

Expected penetration: broadband penetration resulting from a price reduction

0.735: Price elasticity coefficient resulting from a decline in pricing of 1 per cent, according to the equation in Figure 11

Current penetration: penetration of broadband at time of test of price reduction

0.622: constant

Price change: determination of expected price reduction

By relying on this model, the effect of a price reduction between 5 per cent and 25 per cent was estimated for different regions of the world (see Table 15).

Table 15: Impact on weighted average penetration level of fixed broadband of a price reduction (2013)

Region	2013 Household Penetration	5% Price Reduction	10% Price Reduction	15% Price Reduction	20% Price Reduction	25% Price Reduction
Africa	3.12%	3.62%	4.11%	4.61%	5.10%	5.60%
Americas	54.87%	57.79%	60.70%	63.62%	66.54%	69.45%
Arab States	27.93%	30.10%	32.28%	34.46%	36.64%	38.82%
Asia-Pacific	31.05%	33.35%	35.65%	37.95%	40.25%	42.55%
Europe	72.02%	75.13%	78.24%	81.35%	84.46%	87.57%
CIS	36.94%	39.44%	41.94%	44.45%	46.95%	49.45%

Source: ITU

Since the price elasticity is dependent on broadband penetration, the estimates have to begin by calculating the prorated fixed broadband penetration by geography (the second column presents the prorated household penetration). The next five columns calculate what the household fixed broadband penetration would be if prices would decrease according to five scenarios. For example, if broadband prices were to decline by 5 per cent in Central and South America, fixed broadband penetration would increase from 54.87 per cent to 57.79 per cent. As shown in Table 16, the price elasticity is higher for the regions with lower levels of penetration (as is shown in the data that is

compiled in Figure 11) because early adopters are less price sensitive. For example, in regions like sub-Sahara Africa, a 25 per cent price decline could yield an approximate doubling of current penetration levels. The increase in fixed broadband penetration is also substantial in other countries with emerging market economies (see Table 16).

Table 16: Penetration growth (per household) of fixed broadband as a consequence of a price reduction

Region	5% Price Reduction	10% Price Reduction	15% Price Reduction	20% Price Reduction	25% Price Reduction
Africa	15.85%	31.70%	47.55%	63.40%	79.25%
Americas	5.32%	10.63%	15.95%	21.27%	26.58%
Arab States	7.80%	15.60%	23.40%	31.20%	38.99%
Asia-Pacific	7.41%	14.82%	22.23%	29.64%	37.05%
Europe	4.32%	8.63%	12.95%	17.27%	21.59%
CIS	6.77%	13.54%	20.31%	27.08%	33.85%

Note: For each tariff reduction scenario, the growth on broadband penetration was estimated based on the formula of Figure 11.

Source: Katz and Berry (2014)

Table 16 presents data in terms of the increase in penetration resulting from broadband price reductions. As a result, a 10 per cent price reduction yields an increase in penetration of 31.70 per cent in Africa, 15.60 per cent in the Arab States, 10.63 per cent in South and Central America, and so forth.

In this context, taxation could have a detrimental effect on the public policy strategy aimed at deploying broadband. The impact of these different taxation approaches on total cost of ownership of broadband service varies widely. As mentioned before, in Mexico the impact of taxes on total cost of ownership of mobile broadband is 18.4 per cent, in South Africa it is 15.2 per cent, in Brazil it reaches 29.8 per cent, while in Bangladesh it is 54.8 per cent. On the other hand, in Malaysia, the effect of taxes on mobile broadband cost of ownership amounts to only 6.1 per cent.

At a correlational level, taxation appears to have an impact on the deployment of mobile broadband. For example, *ceteris paribus*, there may be some association between the very high level of taxes in Brazil and its very low penetration level of 3G handsets. On the other hand, Malaysia shows a low level of taxes and a high 3G penetration rate. Similarly, an inverse relationship appears to exist between tax burden and adoption of data services when measured by wireless data as per cent of service revenues. If taxes limit adoption of wireless broadband, it is relevant to ask what the ultimate impact of reduced penetration might have on economic growth.

Some countries have reached the conclusion that while foregoing tax collections in the short run, a tax reduction strategy can result in additional adoption of devices and broadband usage, and consequently enhanced economic benefits in the long run. In 1998, the Sweden Government enacted its tax rebate programme, which encouraged employers to purchase home computers for their employees. The price of the computer was deducted from employees' salaries as monthly repayments over a three-year period and employers received a tax credit for the purchase. The programme was credited in part with the country's rise in computer penetration, which reached 93 per cent of individuals by 2012[114]. In January 2010, the Government of Malaysia offered an incentive to consumers, who received tax relief on the broadband subscription fee up to USD 165. The country's Inland Revenue

[114] Source: Katz, R., Berry, T. (2014). *Driving demand for broadband networks and services*. London: Springer.

Board announced in 2011 that these tax benefits extended to smartphone broadband use as well. While the actual devices did not qualify for the additional personal computer tax incentive, tablets such as the iPad did. The Malaysia Income Tax Act 1967 states that the cost of a personal computer – up to USD 1 000 – is deductible. As of 2014, while the deductibility for personal computers was maintained, it could only be made once every three years. On the other hand, the tax relief for broadband expired115.

In a similar case, the Zimbabwe Revenue Authority exempted all ICT equipment of any import duty. This includes computers, cellphones, and other selected equipment. With the stated purpose of promoting the development of the ICT sector, the only tax attached to this equipment is VAT116.

6.2.2 The case of personal computers and tablets

The international market for personal computers and tablets, considered as the devices used to access the Internet is considerably developed. Worldwide shipments of personal computers (both desktop and laptops) in 2013 reached 315.1 million, while tablets shipments amounted to 227.3 million117. Of these volumes, 58 per cent of PCs and 25 per cent of tablets are shipped to emerging markets118. In light of these volumes, import duties and sales taxes remain an important factor in driving purchasing prices up. Retail prices before import duties and sales tax range by manufacturer and product type. Import duties and sales taxes are added to the retail price. The global average import duty rate for a personal computer is 2.1 per cent ranging between 0 per cent to a maximum of 35 per cent; in addition, sales taxes to be added to the purchase price could range from zero per cent to 27 per cent119. Countries with the highest cumulative taxes on PCs include Iran, Argentina, Cambodia, Croatia, and Venezuela, while countries with the lowest taxes include India, Panama, Saudi Arabia, and Singapore (see full table in Annex B.1).

In the case of tablets, the global average import duty rate is 1.2 per cent, with a minimum of zero per cent to a maximum of 16 per cent. Countries with the highest cumulative taxes on tablets include Algeria, Bulgaria, Chile, Ecuador, Lithuania, and Morocco, while countries with the lowest burden comprise Bangladesh, Egypt, Panama, and Sri Lanka (see full table in Annex B.2).

Data indicate that, when considering import duties and sales taxes, European countries appear to be on the high end of the tax rate distribution for PCs and tablets. The Arab States tend to appear in the low end of the distribution, while Latin America, Africa and the Asia-Pacific regions display a moderate tax burden on device imports.

However, in addition, some countries add on top of customs duty and sales tax, a product specific tax, which tends to affect the end-price of PCs and tablets (see Table 17).

The cumulative impact of customs duties, sales taxes and, in some cases, additional levies have, in some cases almost a 50 per cent impact in the price of data access devices. This increase has an impact on the affordability of devices by large portions of the population in countries with emerging market economies. For example, an earlier tax impact study120 concluded that the VAT exemption enacted in Colombia in 2007 and 2008 generated more economic benefits and tax revenues than the losses incurred by the temporary enactment of the measure. If the Colombia Government had not exempted low priced PCs from VAT, its revenues would have been USD 243 million. On the other hand, the VAT

---

115 Weina, Ang "Top 10 tips on filling your tax returns", The Star (April 6, 2014); retrieved from: www.thestar.com.my/News/Nation/2014/04/06/Top-10-tips-on-filing-your-tax-returns/

116 Zimbabwe Revenue Authority (2014). *You can import ICT equipment duty-free.*

117 IDC. *Smart connected device market by product category, unit shipments 2013 and 2017.*

118 IDC. *PC Shipments by Region and form factor 2013-2018.* Juniper Research. *Tablet shipments split by eight key regions. 2015.*

119 Source: Import Duty Calculator, retrieved from http://www.dutycalculator.com/popular-import-items/import-duty-and-taxes-for-personal-computer/

120 Villate, C. and Granados, R. *Estudio Sobre la Exclusión del IVA a los PCs y su Impacto Económico, Competitivo y Fiscal,* Desarrollado para la Cámara Colombiana de Informática y Telecomunicaciones 2009, DC-Colombia.

Table 17: Specific additional duties and taxes on import of PCs and tablets

	Personal Computers	Tablets
Australia	• Import Processing Tax (AUD 48.85)	
Bangladesh	• Advance Trade VAT (4%) • Advance Income Tax (5%)	
Brazil	• Airport fee (50% (Storage fee + Handling fee)) • Storage fee (1% CIFD) • Handling fee (BRL0.015 per KG) • Declaration fee (BRL30.00) • IPI (15% CIFD) • COFINS tax ((9.25% (CIF * (1 + ICMS%) * (Duty% + IPI% * (1 + Duty%)))) / (0.9075 * (1 ICMS%)))	
Burundi	• Administrative Licence Fee (0.5% CIF) • Security Tax (1.15% CIF)	
Chile	• Classification Charge (1% CIF)	
Costa Rica	• (Tourism development tax) (18% CIFD)	
Ecuador	• FodInfa (Children development fund) (0.5% CIF) • ICE (Consumption Tax) (0% CIFD)	
India	• Landing charges (1% CIF) • Countervailing duty (10% (CIFD + Landing charges)) • CESS (3% (Duty + CEX (Education & Higher Education CESS) + Countervailing duty)) • Additional Countervailing Duty (4% (CIFD + Landing charges + Countervailing duty + CESS + CEX (Education & Higher Education CESS))) • CEX (Education & Higher Education CESS) (3% Countervailing duty)	
Indonesia		• Income tax (7.5% CIFD)
Israel	• Import port fee (USD 50.31 Import port fee if weight more 50 kg per shipment)	
Morocco	• Parafiscal tax (0.25% CIF)	
Panama	• ISC (Consumption tax) (5% CIFD)	

Source: Duty Calculator

collected by the acceleration of demand of software, services, and broadband subscription triggered by the accelerated diffusion of PCs was USD 201 million, while the fiscal revenues collected by spillover effects on the rest of the economy reached USD 244 million. The net effect of the measure was an incremental revenue effect to the Colombia Treasury. Other governments followed the Colombia example. For example, in September 2012, the Brazil Government enacted a law suspending certain taxes on PCs, as well as on software for educational use, and other ICT-related services121.

7 Comparison of digital sector taxation with other sectors

The evidence provided so far points to a number of tax asymmetric issues regarding taxation within the digital sector. As such, it includes either ICT/telecommunication operators or digital platform

[121] INTEL (2012). *The merits of reducing taxes on personal computers*.

providers, such as digital advertising and content distribution firms. A question that is also being raised is to what extent is the digital sector taxed at an unfair rate compared to other sectors of the economy. This raises a number of theoretical issues regarding fiscal policy.

First, while the ICT/telecommunication sector is recognized as an engine of economic growth and social development, the burden of taxation borne by the sector is larger than that of other industries. This point is being argued from two angles. The first one raises the issue of whether the effective tax rate for the telecommunication sector, defined as the ratio between the total tax payments in the annual accounts (which includes corporate income taxes and personal income contributions by employers) and gross revenues, is higher than for other sectors of the economy. If the evidence proves this point, then the question would be one of fairness (why do telecommunication firms pay more tax than companies in other sectors of the economy?) as well as economic policy (if the telecommunication sector represents a large multiplier, shouldn't their tax rate be lower than other sectors in order to maximize its adoption and usage?).

The second issue of cross-sector taxation fairness is broader122. If, as a matter of public policy, governments chose to subsidize certain goods, such as fuel and electricity, it falls to other industries, such as telecommunications, to fill the gap left by the subsidies. In other words, the implied cost of the subsidy is the lost revenue that could offset taxes. If subsidies are onerous (as fuel or electricity subsidies generally are), the telecommunication (or/and other sector) sector has to fill the revenue gap through a larger tax burden.

In addition, to the cross-sector argument, taxation fairness is being raised as an issue within the digital eco-system. As pointed above, not all firms within the digital sector are being taxed in the same way: generally speaking, OTT and digital platforms (such as digital advertising and search firms) face a much more benign taxation framework. As mentioned above, the European Union has been focusing on this issue when proposing changes in VAT rules across Europe. This matter is important since it is generally assumed that taxation within industrial sectors should be considered in the context of substitutable goods. A case in point is how taxation of over the top VoIP players is tackled when compared to traditional telecommunication operators.

The following section focuses primarily on the first issue: a comparison of taxation burdens between different sectors of the economy.

7.1 Overview of taxation in other sectors of the economy

A comparative analysis of taxation burden across sectors presents several methodological issues. First, the appropriate metric to measure the taxation burden needs to be defined. There is a general consensus that the effective tax rate (ETR) would be the appropriate metric123. However, data gathering to construct comparative panels across sectors is rather difficult. The usual approach is to divide the taxes paid by the taxable income as reported by public companies in their reports to the stockholders. This presents in turn two problems. From a theoretical standpoint, a more appropriate measure would be marginal tax rates paid by those firms. However, data for this metric is not available. Second, and on a related point, data on taxes paid contained in annual reports does not reflect the real burden of taxation since it implies differences in tax rates, tax exemptions, or even tax strategies followed by said firms.

The second methodological issue raised in conducting these cross-sector comparisons relates to country differences. Sector tax burdens change by country, which means that cross-border averages have little sense. Along these lines, a multinational corporation is bearing different levels of taxation burden. Their annual reports generally tend to blend the total taxes paid, which limits the ability to

[122] This point is raised in GSMA. *Mobile taxes and fees: a toolkit of principles and evidence*. London, February 2014.

[123] The Effective Tax Rate (ETR) for a company is the average rate at which pre-tax profits are taxed. Contrary to the statutory rate, which is legally imposed, the ETR measures the total tax paid as a per cent of the company's accounting income.

conduct a cross-country comparison. Obviously, this issue does not apply for companies operating in a single country, a fact that is quite uncommon particularly in the digital sector.

With these limitations in mind, the following analysis relies on Prof. Aswath Damodaran's data sets124. The sources for the dataset are Bloomberg, Morningstar, Capital IQ and Compustat. The data used has been last updated in January 2015. The data on effective tax rates represents an average rate for all firms in each sector, and reports data for 94 sectors.

The cross-sector comparison of effective tax rates was conducted at a regional, and country level. Three sectors, each of which comprises two or more sub-sectors, were chosen for comparison: the digital sector, tourism, and media. Each analysis includes the number of firms comprising the sample, and the aggregate effective tax rate (which is calculated on the ratio of aggregate taxes to the total sector corporate income). Recognizing that cross-border, cross-sector analysis could be misleading, the comparisons were conducted for some regions or countries separately: Europe, United States, and emerging markets125.

7.1.1 Cross-sector comparisons within the United States

When conducting the comparison for the United States, the effective tax rate (ETR) for the three sectors under consideration varies substantially. The variance in effective tax rates within sectors is also prevalent. For example, within the digital sector, the highest tax rates are found in software (Internet), telecommunication services, and office equipment and services, while the sectors with the lowest rates are software (entertainment), telecommunication equipment, and computer services (see Table 18).

Table 18: Digital sector: US effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Computer services	119	20.89 %
Computers/peripherals	64	25.48 %
Electronics (consumer and office)	28	26.93 %
Information services	67	30.41 %
Office equipment and services	25	31.99 %
Retail (online)	46	24.75 %
Software (entertainment)	20	13.79 %
Software (Internet)	327	39.20 %
Software (systems and applications)	259	23.94 %
Telecom equipment	126	20.09 %
Telecom services	77	31.69 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

[124] Aswath Damodaran is a professor of Finance at the Stern School of Business at New York University, where he teaches corporate finance and equity valuation. He has been compiling data since the 1990s to support his research and teaching in firm valuations. In that sense, data was compiled to value companies rather than support a public policy debate. With that caveat in mind, directional findings regarding the state of affairs could be a useful tool for policy makers.

[125] These are the tables included in Prof. Damodaran's database.

When examining the tourism sector, the hotel/gaming industry, one of the sub-sectors comprising this industry is benefitting from a surprisingly low ETR (10.77%) (see Table 19).

Table 19: Tourism sector: US effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Hotel/gaming	80	10.77 %
Restaurant/dinning	79	32.59 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

The comparison with the media sector would indicate that all sub-sectors are taxed at lower ETR than software (internet) (see Table 20).

Table 20: Media sector: US effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Broadcasting	28	35.59 %
Cable TV	18	34.21 %
Entertainment	84	28.63 %
Publishing and Newspapers	43	17.30 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

In the case of the United States, the tourism sector appears to be most benefitted by a lower ETR. Furthermore, telecommunication services firms also appear to be affected by a relatively low ETR, when compared to software and media companies.

7.1.2 Cross-sector comparison in Europe

The cross-sector comparison for Europe also depicts a wide variance in ETR. Within the digital sector, the highest tax rates are found in retail (online), and telecommunication services, while the sectors with the lowest rates are computer equipment, and software (entertainment) (see Table 21).

Table 21: Digital sector: Europe effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Computer services	217	28.86 %
Computers/peripherals	37	7.19 %
Information services	23	26.16 %
Office equipment and services	37	31.13 %
Retail (online)	34	34.26 %
Software (entertainment)	25	17.82 %
Software (Internet)	137	23.85 %

Table 21: Digital sector: Europe effective tax rate (2014) (continued)

Sub-sector	Number of firms	Aggregate effective tax rate
Software (systems and applications)	229	26.08 %
Telecom (wireless)	16	N.A.
Telecom equipment	53	N.A.
Telecom services	87	31.43 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

On the other hand, contrary to what occurs in the United States, the European tourism sector does not appear to be paying at a much lower ETR than the digital sector (see Table 22).

Table 22: Tourism Sector: Europe effective tax rate (2014)

Sub-sector	Number of firms	Aggregate Effective Tax Rate
Hotel/gaming	126	31.86 %
Restaurant/dinning	40	25.90 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

Finally, the comparison with the ETR of media companies would indicate that all these sub-sectors, except publishing, are taxed at a similar rate or higher than telecommunication services and software firms (see Table 23).

Table 23: Media sector: Europe effective tax rate (2014)

Sub-sector	Number of firms	Aggregate Effective Tax Rate
Broadcasting	31	46.69 %
Cable TV	11	29.59 %
Entertainment	83	31.63 %
Publishing and Newspapers	110	21.98 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

Interestingly enough, the comparison of ETR across the same industries for the European continent indicates a reversal. Telecommunications services firms exhibit the second highest ETR, while media companies incur the lowest. E-commerce firms pay taxes at 5 percentage points more than media firms as well.

7.1.3 Cross-sector comparison in countries with emerging market economies

The cross-sector comparison of effective tax rates for countries with emerging market economies also depicts a wide variance in ETR. Within the digital sector, the highest tax rates are found in office equipment, and software (entertainment), while the sectors with the lowest rates are computer equipment, telecom services and software systems (see Table 24).

Table 24: Digital sector: countries with emerging market economies effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Computer services	418	24.53 %
Computers/peripherals	194	20.63 %
Electronics (consumer and office)	86	28.19 %
Information services	51	28.22 %
Office equipment and services	58	39.43 %
Retail (online)	11	N.A.
Software (entertainment)	52	31.77 %
Software (Internet)	142	21.93 %
Software (systems and applications)	297	20.79 %
Telecom (wireless)	67	29.46 %
Telecom equipment	256	21.30 %
Telecom services	110	19.50 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

Table 25: Tourism sector: Countries with emerging market economies effective tax rate (2014)

Sub-sector	Number of firms	Aggregate effective tax rate
Hotel/gaming	407	12.96 %
Restaurant/dinning	78	25.58 %

Source: Damodaran Online, at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

Table 26: Media sector: Countries with emerging market economies effective tax rate (2014)

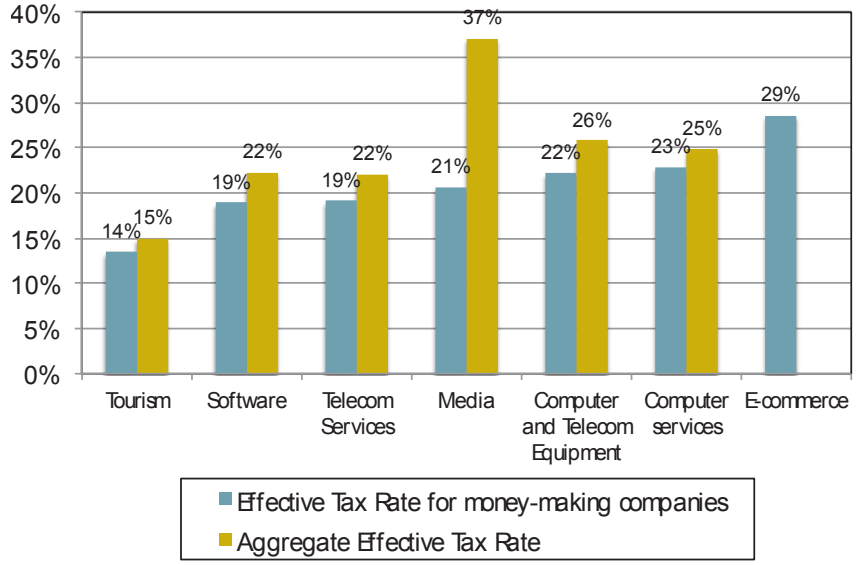
Sub-sector	Number of firms	Aggregate effective tax rate
Broadcasting	57	31.18 %
Cable TV	27	17.92 %
Entertainment	143	66.42 %
Publishing and Newspapers	154	15.35 %

Source: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

However, the tourism sector in countries with emerging market economies appears to be, on a prorated basis, paying taxes at a much lower effective rate than the digital sector. The aggregate effective tax rate of tourism firms in countries with emerging market economies is five percentage points lower than telecommunication services and software firms, and between eight and fifteen percentage points lower than computer and telecommunication equipment, computer services and e-commerce companies.

In sum, in countries with emerging market economies, the tourism sector ETR is significantly lower than media and all ICT related sectors (see Figure 12).

Figure 12: Emerging countries: Effective tax rate by industry (2014)



Sources: Damodaran Online at: http://people.stern.nyu.edu/adamodar/New_Home_Page/home.htm

7.2 Conclusions of the comparison of digital sector taxation with other sectors

The comparison of effective tax rates (ETR) across sectors by region indicates significant differences:

- United States: the range of aggregate ETR across technology intensive sectors is seven percentage points, which might raise a potential distortion within the digital eco-system.
- Europe: the ETR for companies in the telecommunication and computer services is between five and seven percentage points higher than that of the media sector. It is worth examining this potential asymmetry to determine whether this is a source of distortion.
- Countries with emerging market economies: the aggregate effective tax rate of the tourism sector is five percentage points lower than telecommunication services and software sectors, and between eight and fifteen percentage points lower than computer and telecommunication equipment, computer services and e-commerce. The lower tax rate of the tourism sector is frequently associated with policies aimed at promoting competitively priced destinations, in addition to the fact that a significant number of small businesses in the tourism sector fall underneath a compulsory tax bracket126. Considering the importance of the technology sectors as economic multipliers, it would be relevant from a development policy standpoint to reexamine this asymmetry.

It is important to mention, however, that these conclusions can only be considered tentative given the paucity of data, and the fact that these estimates are based on annual reports, that provide data on taxes being paid on a specific year, implying differences in rates, tax exemptions, or even tax strategies implemented by each firm. It is, therefore, important that governments conduct detailed assessments of the tax situation of digital firms operating in their country to define appropriate fair and unbiased approaches that allow them to collect revenues, while ensuring that digital operators continue contributing to economic growth.

[126] Foreign Investment Advisory Service (2006). *Sector study of the effective tax burden: South Africa*. World Bank. P. 51.

8 Lessons learned, best practices and fiscal policy recommendations

In the introduction to this report, several questions were raised and reviewed to demonstrate the ongoing debate regarding taxation in the digital economy. Recognizing that answers to these questions should be developed based on country-specific policy trade-offs between revenue generation and the potential negative impact on the development of the digital sector as well as the telecommunication/ICT market environment, the evidence provided in this report should help understand the implications of these decisions:

- What is the appropriate level of taxation on capital equipment purchased by telecommunication operators? Taxation of equipment purchased by ICT operators, such as import duties and sales taxes, has a negative impact on capital investment. Governments should carefully consider the enactment of tax exemptions similar to those considered for development of critical industries.
- How should Internet sales be taxed? No easy answers in this area. Taxation of goods sold over the Internet should be considered in light of the benefits to consumers implied in a tax-free environment. For example, consumer welfare in this domain has been identified in areas such as lower purchase price[127]. On the other hand, no taxes for goods purchased over the Internet have a potential distortion vis-à-vis physical distribution channels. The European Union is moving to a single, unified VAT regime to ensure a fair collection, while stimulating development of smaller start-ups selling online128.
- How should consumption of digital goods be taxed? Again, this is an evolving policy domain. However, if the objective is to protect national digital industries, no taxation of global players offering digital goods has a potential distortionary effect.
- Should the consumer purchasing wireless devices and personal computers be taxed? If the objective is to maximize adoption of digital access devices, the evidence points out that tax minimization fosters increased adoption, which in turn results in large economic gains, which compensate for the foregone tax revenues.
- Should the providers of digital platforms, such as Google and Facebook, be taxed at the country where revenues are generated, or should they benefit from international rules that allow them to take corporate tax exemptions? This question is at the core of an ongoing debate, which is critical for countries with emerging market economies. Global platforms have been the preeminent drivers of Internet adoption throughout the world. Furthermore, their indirect contributions to the development of the digital economy have been significant. While the current tax regime might be a source of asymmetry within the digital sector (particularly vis-à-vis telecommunication operators), governments in countries with emerging market economies need to carefully assess the convenience of moving into this domain, which might entail a risk in hampering growth of local demand and usage.
- Should Internet service providers pay taxes the same way as telecommunication carriers? Again, this is an evolving concept with little evidence so far. However, some analysis point out that taxing Internet service providers in a way similar to telecommunication operators, while distortive, has the potential for increasing the cost of broadband access.

Beyond these preliminary conclusions, two additional generic points for tax policy making are worth reviewing, on tax imbalances and how to maximize the impact on digitization.

127 A lower "price penalty" has been identified in several categories of goods (housing, personal care, toys, electronics) purchased through e-commerce (see Buchanan, L. and Parlapiano, A. (2014). "Costs for Americans reflects an increase in quality over the past 10 years". *New York Times*. April 30, 2014.

128 See European Commission. A Digital Single Market for Europe; Commission sets out 16 initiatives to make it happen. Brussels, May 6, 2015.

8.1 Addressing tax imbalances

Throughout this study, the distortive effect of taxes in the digital eco-system has been identified at several levels:

- The first one refers to the disparity in tax burdens imposed on telecommunication operators when compared to other operators of the digital eco-system (digital advertisers, social networks). In Europe, Internet firms have a five-point lower effective tax rate than telecommunication service companies. In the case of countries with emerging market economies, Internet companies have a seven-point lower ETR than wireless operators. In India, wireless telecommunication operators bear a burden that is 14 points higher than Internet firms. Finally, the difference would also appear to exist in China, where both wireless and full service telecommunication companies are taxed with a rate that is five points higher than Internet players.
- A second dimension of taxation asymmetry within the digital sector exists when one looks at global players. In general, the provision of telecommunication services in a given country requires the deployment of local infrastructure in the form of points of presence, interconnection points, switches and distribution networks. From a tax standpoint, this constitutes a "permanent establishment" and renders the service provider liable for payment of taxes, contributions, and telecommunication specific fees within that country. On the other hand, a global digital player that relies on the telecommunication operator infrastructure to access the end customer does not necessarily require an in-country presence. This is directly related to the business model and operating processes of the global digital player, which is "asset-light" and benefits from having a centralized R&D and processing infrastructure (in the form of data centres located in the home country). The derived value of this configuration is that, contrary to what happens with telecommunication service providers, global digital players are liable for a much reduced tax burden in countries beyond that of his home office. Some digital players like the OTT operators do not even have a physical presence, all transactions are booked out of the country, and therefore, while they generate revenues and profits, their ETR is substantially low. Other players, like the major digital advertising platforms set up sales offices and therefore become liable for a small tax burden, derived from social charges for local employees, VAT for some goods purchased in-country, and, in some cases, some country-specific taxes.
- The third dimension of taxation asymmetry refers to in-country comparison of tax burden of the telecommunication sector, compared to the other providers of goods and services. In Europe, the effective tax rate for companies in the telecommunication and computer services sub-sectors is between five and seven percentage points higher than that of the media sector. In countries with emerging market economies, the aggregate effective tax rate of the tourism sector is five percentage points lower than telecommunication services and software sectors, and between eight and fifteen percentage points lower than computer and telecommunication equipment, computer services and e-commerce.

Governments should examine these asymmetries to determine whether they are source of distortion in particular, considering the importance of the technology sectors as economic multipliers, it would be important for governments of countries with emerging market economies to examine these imbalances and assess their potential negative impacts.

8.2 Maximizing impact on digitization

There is extensive evidence supporting the fact that digitization has significant impact on economic growth129. In this context, taxation of digital goods and services might have a detrimental impact on the rate of development of digitization. For example:

- Taxes on consumption of digital goods and services (for example, downloading a movie, or purchasing a good through an e-commerce site) impose an excess burden if demand is elastic, and consumers replace the digital good or service for a substitute (for example rent a DVD or purchase a good in a physical store). This has an overall negative impact on the efficiency of the economy.
- High taxes on production inputs, such as network equipment have a negative impact on business development130. This can operate by reducing the capital investment rate of rate. It can also affect investment if the provider of service opts to absorb a portion of taxes to be paid by the consumer. This could again have a negative impact on investment.
- In some cases, operators may increase their pre-tax price (a behaviour known as over-shifting) when a tax is imposed. This can have a negative impact on adoption.

Because digital technologies have an impact on the economy, increasing efficiency of production processes, facilitating the circulation of goods, and creating new businesses, the taxation of digital goods and services should be approached with care, preventing any erosion of their spill-over contribution to GDP growth. Furthermore, because of the economic impact, it has been shown that excessive taxing digital goods and services could limit adoption, restricting the positive contribution to GDP. Thus, the tax collected is outweighed by tax foregone on "lost" GDP.

In developing fiscal policies, governments need to consider the trade-offs between revenue generation and the potential negative impact of the development of the digital sector. ICT/telecommunication operators already contribute significant tax revenue. These contributions include the value-added tax (VAT), social security tax, corporate tax, regulatory fees, and telecom sector-specific taxes.

In crafting policy, recognizing that part of the taxation burden is to be borne by consumers, governments should systematically consider the impact taxes have on the total cost of ownership of device (e.g. smartphone, PC or tablet) and its related subscription cost. This metric, which includes not only the acquisition price but also all related taxes to be paid decreases service affordability and therefore determines whether an excessive burden creates a barrier to adoption by lower income users. Furthermore, while the telecommunication sector of the digital eco-system should pay appropriate taxation and regulatory fees, a balance is needed between short-term revenue schemes and long-term strategies to support industry innovation and growth.

Considering the premises raised above, fiscal authorities have to carefully assess the trade-offs regarding the imposition of taxes and tariffs. The impact of levies on the total cost of ownership of devices and service access will have a negative impact on technology affordability. Arguments such as the imposition of a "luxury tax" on smartphones will not have any redistributive impact. Furthermore, in many cases import duties have no clear impact in the protection of domestic industries. Finally, the imposition of "sector specific taxes" runs counter to classical principles of tax policy.

The evidence regarding the economic impact of digital industries continues to grow, ranging from fixed broadband to computing, the Internet, and mobile broadband. From that perspective, the argument to reduce potential distortions emerging from over-taxation of the sector is gaining ground. As others

---

[129] See Sabbag, K., Friedrich, R., El-Darwiche, B., Singh, M., Ganediwalla, S. and Katz, R. (2012), ''Maximizing the impact of digitization'', in Dutta, S. and Bilbao-Osorio, B. (Eds), *The Global Information Technology Report 2012*, World Economic Forum and INSEAD, Geneva; Katz, R. y Koutroumpis, P. "Measuring digitization: A growth and welfare multiplier", *Technovation*, July 2013. Katz, R., Koutroumpis, P. and Callorda, F. "Using a Digitization index to measure economic and social impact of digital agendas", *Info,* January 2014.

[130] Cave, R. "Telecommunications service taxation: understanding the process". ITU, 2011: www.itu.int/ITU-T/worksem/taxation/201109/index.html

have argued, though, the reduction in digital sector taxes needs to be weighed in terms of the potential reduction in revenues. Having said that, establishing a balanced view of tax policy across sectors in order to eliminate distortions is a tall order.

Annex A: Models estimating the impact of taxation on telecommunication capital investment

In general, the model estimates the impact of different tax rates among states and years, controlling for state fixed effects, such as wealth of the economy, demographic profile, and urban/rural population, variables considered to be proxies for fixed effects. In addition, the model includes a control variable lagged one year to account for the effect of budgeting inertia in investment decisions1. The model for assessing the impact of sales taxes on investment was structured as follows:

Taxable Investment $PC_{it} = \alpha_1$ (Equipment State Sales Tax_{it}) + α_2 (Median Income $_{it}$) + α_3 (Population $_{it}$) + α_4 (Human Capital $_{it}$) + α_5 (Rural Population $_{it}$) + α_6 (Investment PC_{it-1}) + α_7 (Population 60 years or more$_{it}$) + α_8 (Population between 20/34 years $_{it}$) + α_9 (Population between 5/19 years $_{it}$) + e_{it}

Table A1: Variables of sales taxes effect on investment

Variable	Explanation	Rationale	Source
State communications investment per capita	Sum of taxable state investment by operators per capita in 2010 dollars (66 per cent of the total investment)	Total state communications investment normalized by population size	Broadband Tax Institute
State sales tax rate on initial equipment	Effective sales tax rate on cable or telecom	Independent variable	Mackey (2011)
Median Income	State Median Income	Control variable given that the level of income impact on investment	US Bureau of Economic Analysis
Population	Population at state level	Control variable	US Bureau of Economic Analysis
Human Capital	Share of economically active population with at least High School education	Control variable given that more educated population drives demand	National Broadband Plan Database (FCC)
Rural Population	Share of rural households at the state level	Control variable given that rural population should be inversely related with broadband deployment	US Census Bureau
State communications investment per capita lagged	Sum of state investment by cable TV or telecom operators per capita one year before (in 2010 dollars)	Control for investment inertia	Broadband Tax Institute
Population 60 years or more	Share of population with 60 years or more	Control for age of the population	National Broadband Plan Database (FCC)
Population between 20/34 years	Share of population between 20 and 34 years	Control for age of the population	National Broadband Plan Database (FCC)
Population between 5/19 years	Share of population between 5 and 19 years	Control for age of the population	National Broadband Plan Database (FCC)

Source: Katz et al. (2012)

[1] In other words, it accounts for the importance of the prior year in predicting investment in the current year, an effect observed above in the review of the research literature on capital planning.

Model results for the telecom and cable TV industries are presented in Table A2.

Table A2: Model of impact of sales tax rate on investment – OLS Model of impact of sales tax rate on investment with autoregressive factor (2006-2010)

Dependent Variable	Cable Investment		Wireless & Wire-line Investment	
Sales Tax Rate	-0.3085	*	-0.8529	*
	(0.1586)		(0.5142)	
Median Income (2010 Dollars)	-0.1655		0.5817	*
	(0.1239)		(0.3524)	
Population	0.2508	**	-0.3662	
	(0.0984)		(0.2690)	
Human Capital	0.2382		0.2689	
	(0.1893)		(0.5602)	
Rural Population	-0.0936	**	-0.0620	
	(0.0441)		(0.1461)	
Investment the last year	0.5019	***	0.4375	***
	(0.0465)		(0.0408)	
60 years or more	-0.3200		-8.7256	
	(0.8200)		(6.3690)	
Between 20/34 years	-0.5230		-3.8209	
	(1.2667)		(6.7247)	
Between 5/19 years	-0.8622		-6.9562	*
	(0.6340)		(3.5852)	
Constant	28.6410		434.7922	
	(47.9686)		(301.4056)	
R^2	0.7984		0.4808	
F (9,190)	50.99		37.61	
Prob > F	0.0000		0.0000	
Number of Observations	200		200	

Independent Variables: *Sales Tax Rate, Median Income, Population, Human Capital, Rural Population, Investment lagged, Age of Population.*

Note: ***, **, * significance at 1%, 5%, and 10% level

Note: The median income coefficient is estimated over USD 1 000 multiple

Source: Katz et al. (2012)

The coefficient for the sales tax rate variable indicates that a decrease of 1 percentage point in this rate (for example, from 4.45 per cent to 3.45 per cent in cable TV and from 4.02 per cent to 3.02 per cent in wireless and wireline equipment) would increase cable TV investment by USD 0.31 per capita and wireline and wireless investment by USD 0.85 per capita across all states. These results are statistically significant at the 6 per cent level for cable TV investment and 10 per cent for wireless and wireline. Furthermore, the coefficients imply an elasticity of investment per capita due to a change in sales tax rate, which is calculated as follows:

$$Elasticity\ of\ inv.\ p.c. = \frac{(-0.3085 * Old\ average\ sales\ tax)}{Average\ investment\ per\ capita}$$

Or,

$$0.0408 = \frac{(-0.3085 * 4.45)}{Average\ investment\ per\ capita}$$

Annex B: Taxes on PCs and tablets

Table B.1: Cumulative customs duty and sales taxes on personal computers (2014)

Cumulative taxes	Africa	Americas	Arab States	Asia-Pacific	CIS	Europe
0 %- 5 %			Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates	India, Sri Lanka, Bangladesh		
5 %- 10 %	Nigeria	Panama	Egypt	Australia, Indonesia, Japan, Malaysia Singapore, Thailand		Switzerland, Slovakia
10 %- 15 %	Botswana, Lesotho, Namibia, South Africa, Swaziland,	Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua		Philippines, New Zealand		
15 %- 20 %	Kenya, Burundi, Rwanda, Tanzania, Uganda	Colombia, Dominican Republic,Mexico, Peru, Bolivia	Jordan	China, Pakistan, Republic of Korea	Russia, Bulgaria	Austria, Cyprus, Estonia, France, Germany, Israel, Malta, Turkey, United Kingdom
20 %-25 %		Ecuador	Algeria, Morocco			Belgium, Czech Republic, Finland, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovenia, Spain,
25 %- 30 %		Chile, Paraguay, Venezuela		Cambodia		Croatia, Denmark, Norway, Sweden
30 %- 56 %		Uruguay, Argentina		Iran		

Source: Duty Calculator; analysis by the author

Table B.2: Cumulative customs duty and sales tax on tablets (2014)

Cumulative Taxes	Africa	Americas	Arab States	Asia Pacific	CIS	Europe
0 %- 5 %			Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates	Bangladesh, India, Sri Lanka		
5 %- 10 %	Nigeria	Panama	Egypt	Australia, Indonesia, Japan, Malaysia, Singapore, Thailand, Viet Nam		Switzerland
10 %- 15 %	Botswana, Lesotho, Namibia, South Africa, Swaziland	Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua		Iran, New Zealand, Philippines		
15 %- 20 %	Burundi, Kenya, Rwanda, Tanzania, Uganda	Bolivia, Colombia, Dominican Republic, Mexico,Peru, Venezuela,	Jordan	China, Pakistan, Republic of Korea	Russia	Austria, Cyprus, Estonia, France, Germany, Israel, Malta, Slovakia, Turkey, United Kingdom
20 %-25 %		Ecuador, Chile	Algeria, Morocco	Cambodia		Belgium Bulgaria Croatia Czech Republic Denmark Finland Greece Iceland Ireland Italy Latvia Lithuania Netherlands Poland Portugal Romania Slovenia Spain
25 %- 30 %		Paraguay				Hungary
30 %- 56 %		Argentina, Uruguay				

Source: Duty Calculator; analysis by the author

GSR discussion paper

Regulation and the Internet of Things

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 25 June 2015.

The views expressed in this paper are those of the author and do not necessarily reflect the opinions of ITU or its Membership.

Table of Contents

Page

1. Introduction **5**

2. Internet of Things concepts and deployment **6**

3. Development trends and areas of application **9**

4. Challenges and opportunities **12**

4.1 Cost and reliability 13

4.2 Connectivity 14

4.3 Standards 16

4.4 Open platforms, data and APIs 18

5. Policy and regulatory implications and best practices **19**

5.1 Licensing and spectrum management 20

5.2 Switching and roaming 22

5.3 Addressing and numbering 23

5.4 Competition 23

5.5 Privacy and security 24

6. Conclusions **28**

7. Acknowledgments ..... Error! Bookmark not defined.

References **30**

©ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Regulation and the Internet of Things

Author: Prof. Ian Brown, Oxford Internet Institute, University of Oxford, United Kingdom[1]

Executive summary

This discussion paper examines the implications of the Internet of Things (IoT) for individuals, businesses and societies, and particularly the issues that telecommunications and other regulators will need to consider as IoT systems proliferate in developed and developing economies.

Broadly speaking, IoT refers to the addition of communications and sensing capabilities to a very wide range of physical objects. In the next decade, technology companies and consulting firms expect tens of billions of IoT devices to be deployed – from parking meters, thermostats, cardiac monitors, tires, roads, car components, to supermarket shelves and many other types of physical object – driven by an ongoing rapid reduction in the cost of sensors, processing and networking technologies.[2] IoT devices can share data directly using protocols such as Wi-Fi and Bluetooth, and via mobile phone networks and specialised radio networks, as well as over the global Internet.

As well as device manufacturers, network operators, application platforms and software developers form a broader ecosystem of companies developing IoT services. Data analytics services, often cloud-based, are also important components of IoT systems.

IoT systems support a broad range of applications, from monitoring and managing individual health and wellbeing, improving energy efficiency, increasing industrial process quality and reliability, to reducing traffic congestion and enabling the development of new products and services – especially based on pay-per-use charging.

IoT devices will have the biggest societal impact where they are used together in larger, inter-connected, systems. At the macro-level, two of the areas of greatest IoT development and investment are smart cities – where infrastructure and building systems will improve the efficiency and sustainability of a whole range of urban activities – and smart power and water grids. Closer to the individual, “connected vehicles” with hundreds of separate sensors will be safer, more reliable, and able to participate in sophisticated congestion management systems. And population health and wellbeing – a challenge to governments around the world as populations grow older, with a corresponding increase in age-related chronic conditions – could be significantly enhanced with IoT-based systems used by individuals, carers, primary care doctors, and hospitals. Devices such as insulin pumps and blood-pressure cuffs can monitor patients and report warning signs of conditions such as diabetes and heart disease.

The public and private sector are continuing to fund significant levels of IoT research and development, in areas such as modularity, reliability, flexibility, robustness and scalability. But the basic capabilities needed for many applications are already well understood, and becoming available through smartphones and other standard platforms. These devices will also address some of the cost issues that have held back growth in the past, although cost and reliability remain issues for large-scale systems, as does connectivity. A significant

opportunity is the greater use of open data and Application Programming Interfaces (APIs), which can enable a higher level of innovation in IoT systems.

As IoT systems grow, issues of connectivity (with machines and humans) and addressing become more important. Enabling peer-to-peer connections between devices can increase the reliability of communications, compared to requiring a large and complex global network, and matches the common use case of an individual discovering and interacting with nearby devices. But where devices must be globally reachable – most likely, via the Internet – a large address space is required to individually identify each one. Meeting this requirement would be an additional benefit of global adoption of the next version of the Internet Protocol, IPv6.

The purpose of this paper is to raise awareness among the ICT regulatory community of the changes led by the advent of IoT, examining the challenges and opportunities to understand how this is impacting consumers, businesses, governments and society at large. There are particular regulatory implications for licensing and spectrum management, switching and roaming, addressing and numbering, competition, security and privacy – some familiar to telecoms regulators, and other areas where different regulators typically take a lead.

The Internet of Things

What?

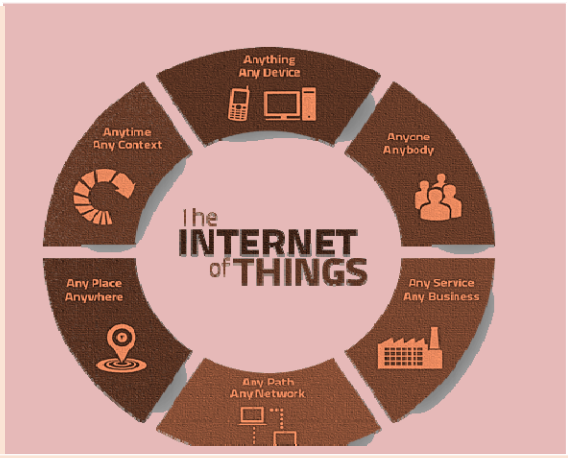
"A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication" (ITU-T)

Who?

Device manufacturers, network operators, application platforms, software developers and (cloud-based) data analytics services providers

How?

Connection of IoT devices via Wi-Fi, Bluetooth, mobile phone networks, specialized radio networks, global Internet



Main current areas of investment

- **Smart cities**
- **Smart metering & grids**
- **Connected vehicles**
- **Healthcare**

Main Impacts

- **Monetary/economic impact: trillions of dollars annually within a decade**
- **Societal impact: Smart cities – infrastructure, transport and buildings – by improving efficiency and sustainability of a whole range of urban activities; smart power and water grids (smart meters)**
- **Individual impact: e.g. transport safety through "connected vehicles"; population health and wellbeing can be enhanced, enabling e.g. care at home**

Challenges

- **Cost needs to fall, reliability needs to improve**
- **Issues of connectivity, user interfaces and addressing**
- **Regulatory implications for licensing and spectrum management (access required to 300 MHz-3GHz but also NFC at 13 MHz or EHF bands, AM/FM bands in VHF range, Wi-Fi and 4G mobile networks), standards (interoperability e.g. ITU-T's initiative IoT-GSI), competition (e.g. impact on competitiveness of different markets, customer lock-in due to fixed SIMs in each device etc…), security and privacy ("by design" approach desirable)**

1. Introduction

Plummeting electronics and communication costs have set the stage for a rapid expansion of the Internet of Things (IoT) – the billions of everyday physical items that now have sensors and network links, enabling them to remotely share data about themselves, their users and environment. In the next decade, technology companies and consulting firms expect tens of billions of IoT devices to be deployed, with a total annual economic impact in the trillions of US dollars.[3,4,5]

Companies manufacturing IoT devices are only one part of a broader ecosystem of organisations developing the IoT. The data created by devices can be shared via communications networks, platforms (including social media sites), and accessed and controlled by third-party applications – often running on users' smartphones (which themselves contain an increasingly diverse range of sensors).[6]

This discussion paper examines the concepts, technologies, and societal changes influenced by the IoT and related technical developments – which include convergence, cloud services, data analytics, the proliferation of sensors, measuring and monitoring humans, machines and things – that are leading to a shift from human-to-human communications, to machine-to-machine (M2M) and everything-to-everything communications.

The purpose of the paper is to raise awareness among the ICT regulatory community of the changes led by the advent of IoT, examining the challenges and opportunities to understand how this is impacting consumers, businesses, governments and society at large. The most important regulatory implications are in the areas of licensing, spectrum management, standards, competition, security and privacy.

Box 1: Republic of Korea's Master Plan for Building the Internet of Things

The government of the Republic of Korea has developed a master plan to use IoT to improve public administration; increase industrial productivity, efficiency and added value; and improve the safety and quality-of-life of individuals. It sees the country as a potential global leader in IoT products and services given its top-class ICT infrastructure and manufacturing capacities.

The plan aims to increase the domestic IoT market fourteen-fold over the seven years to 2020, with a 30% increase in productivity and efficiency in user companies. Because of the small domestic market, cooperation with global businesses is an important part of the strategy. Domestically, new software services in advanced manufacturing will enable growth of traditional industries and new software companies. The government will promote joint research and demonstration projects with the Trans-Eurasia Information Network, which connects 19 Asian and 34 European countries.

Information security is one key focus of the plan, with the government aiming to establish an information sharing and analysis framework with governments such as the US, Japan and EU. The country's IoT Innovation Center will provide a test-bed environment for security functions and promote security and privacy by design in IoT systems.

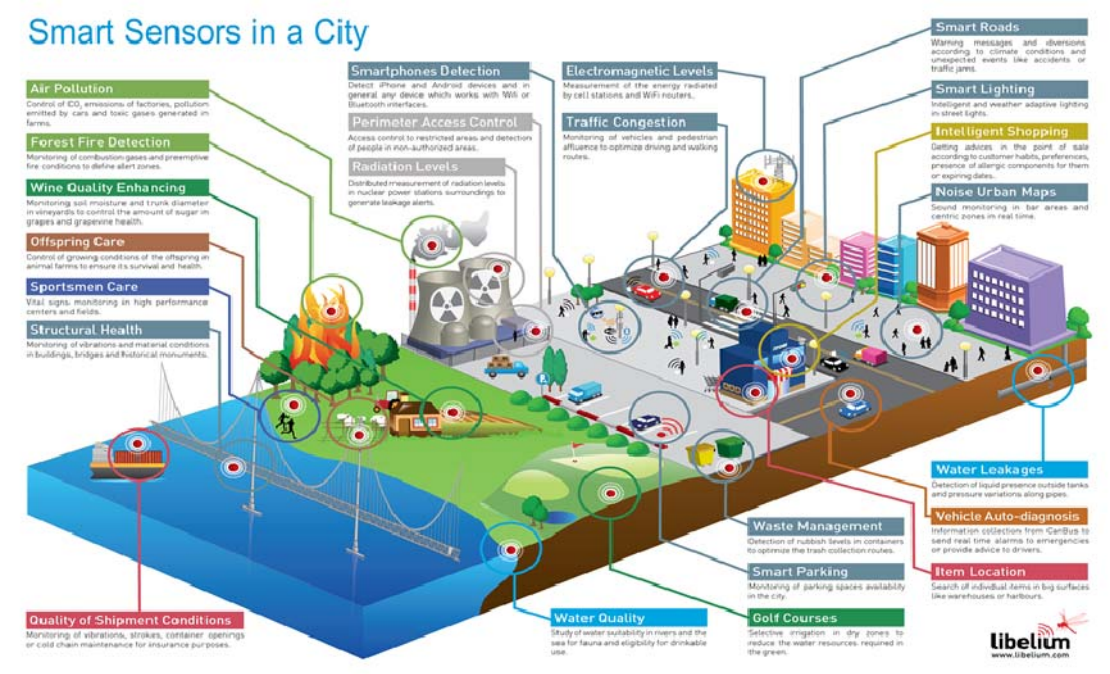
Source: Ministry of Science, ICT and Future Planning, Republic of Korea, 8 May 2014.

2. Internet of Things concepts and deployment

The ITU-T's definition of the Internet of Things (IoT) is "A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies."[7] This refers to the network of remotely linked tags, sensors and actuators (motors and other mechanisms to cause an action within a device) that are increasingly being built into objects throughout the physical world, driven by ongoing rapid falls in the cost of microchips, sensors and communications capacity.

Collectively, with slightly different emphases, these technologies are also known as ubiquitous/pervasive computing, cyber-physical systems, smart environments/spaces/cities (shown in figure 1, and discussed in the next section), the industrial Internet (focused on manufacturing processes), and ambient intelligence.

Figure 1: Smart cities



Source: Libelium.

The term Machine-to-Machine (M2M) communication is used to refer to communication directly between IoT devices, often via cellular networks. The mobile industry association GSMA predicts between 1 and 2 billion M2M connections by 2020.[8] This has regulatory implications relating to switching and roaming, discussed further below.

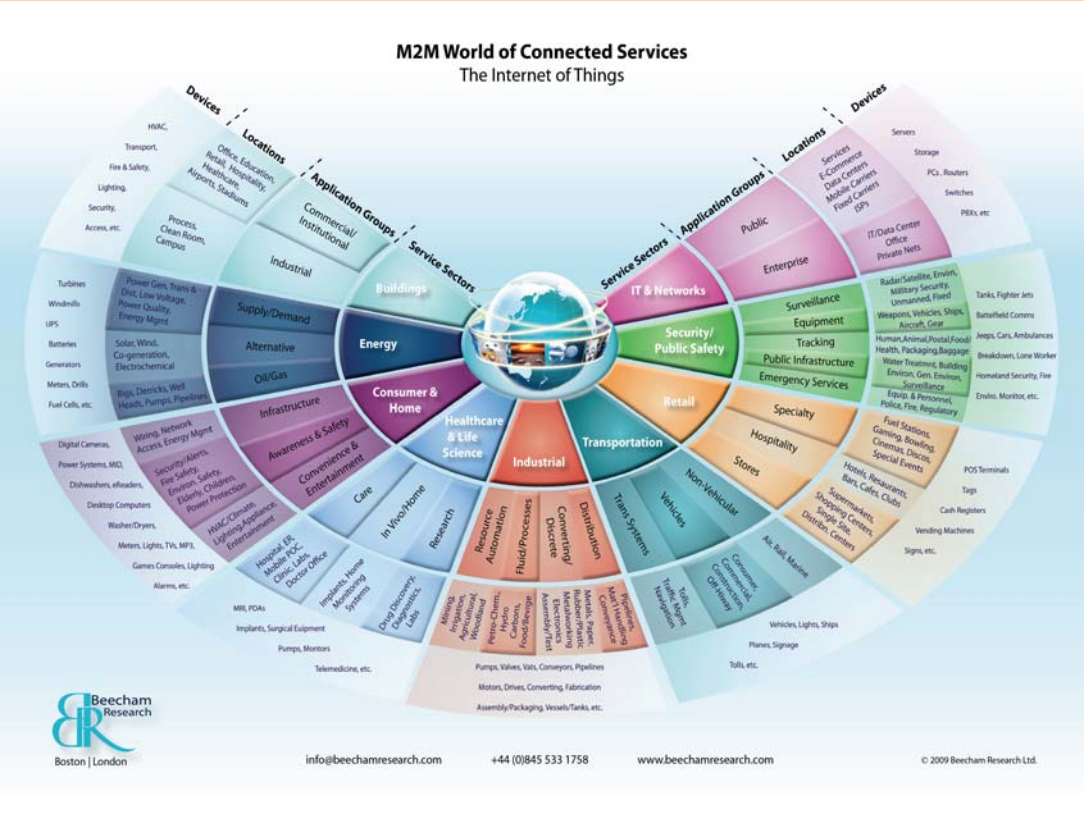
The IoT enables a very broad range of applications – from more efficient agriculture, manufacturing, logistics, counterfeit detection, monitoring of people, stock, vehicles, equipment and infrastructure, to improved healthcare, retailing, traffic management, product development and hydrocarbon exploration. It also enables new business models –

such as car and truck rental clubs, whose members can book and use vehicles parked around their neighbourhood almost on-demand; or "pay-as-you-drive" insurance based on precise driving patterns, behaviour, and risk.

The simplest IoT technology, passive Radio Frequency Identification (RFID) tags, is already widespread in retail, transit ticketing and access control. Near Field Communication (NFC) is now included in newer smartphones, with one prominent application being contactless payments via Visa's payWave and Mastercard's PayPass standards. Specialist sensors and processors in smart phones, watches, bracelets and clothes can collect, process and share data about individuals and their environments.

RFID and NFC only work at close range. M2M systems send information over cellular networks, such as electricity meter readings to energy companies, and car airbag deployment notifications to emergency services, with hundreds of millions of systems being deployed around the world, as shown in figure 2. Both have regulatory implications for licensing and spectrum management – discussed further below.

Figure 2: Machine-to-machine (M2M) services



Source: Beecham Research.

Many M2M devices use standard mobile Subscriber Identity Modules (SIMs) for identification and authentication. Unlike mobile phones, these devices are often located in diverse, unsupervised locations, and subject to wind, rain, large temperature changes, and vibration. To protect the SIM and also prevent theft in such situations, it is often attached permanently and securely to the device.[9]

M2M communications are often periodic and uplink heavy (especially if video is being streamed from cameras, sometimes in high definition), whereas many core and access communications networks are currently configured to support the downlink-heavy communications typical of Internet use.[10]

In the ITU-T model, communications network providers are responsible for:

- Access and integration of resources provided by other providers;
- Support and control of the IoT capabilities infrastructure;
- Offering of IoT capabilities, including network capabilities and resource exposure to other providers.[11]

Depending on the requirements of specific applications, there may be some degree of business integration between device, network, platform and application providers.

Box 2: China's large-scale M2M deployment

China is the world's largest M2M market, with 50 million connections by 2014. China Mobile, China Telecom and China Unicom are all developing large M2M businesses, with support from the Chinese government, which has identified IoT as an "emerging strategic industry" and is investing US$603bn in the M2M ecosystem in the decade to 2020.

The energy (including smart grid) and transportation (including freight tracking) sectors have been early adopters, with increasing demand in the automotive, smart city, healthcare, education and retail sectors. China Unicom connects BMW cars to the BMW ConnectedDrive service, providing embedded SIMs and hosting call and data centres. China Telecom's "Mega Eye" business supports 800,000 video cameras in 20 different industry sectors. The growth of 4G networks will further support applications such as video surveillance and in-car multimedia services.

Hundreds of Chinese cities are deploying smart city technologies, such as intelligent traffic management systems that adjust signals to ease congestion and help drivers find parking spaces, and to monitor pollution and noise sources. Mobile healthcare and education services are being developed to reach patients and schools in remote areas, as well as enhanced emergency response and home health monitoring applications, with Unicom developing smart ambulances that can send patient monitoring data ahead to the destination hospital. China Mobile has developed M2M applications to help farmers to remotely manage greenhouses and irrigation systems, and forest managers to monitor fire hazards.

Source: GSMA, How China is set for global M2M Leadership, June 2014.

3. Development trends and areas of application

The IoT sector has grown sometimes unevenly[12] over the last fifteen years, as hardware developments have made these technologies available at the low cost, size and energy consumption necessary. But many applications have been incremental improvements to existing business processes, developed by the incumbent firms that can afford the investment required. It may require the further growth and entry into new markets of businesses specialising in IoT services, along with further cost reductions, to enable the radical disruption of existing industries that is predicted by many technology companies and consulting firms.[13]

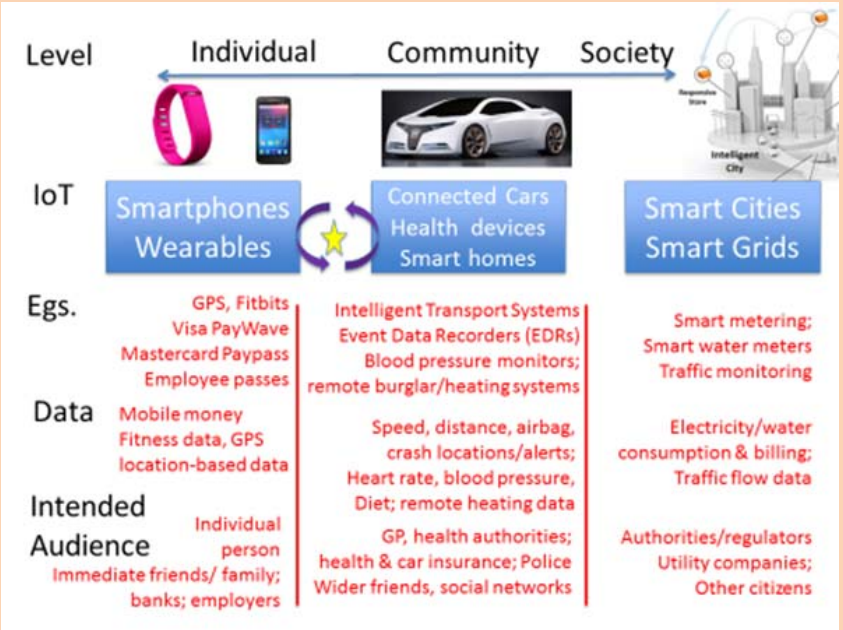
With Near Field Communication, smartphones can act as a universal platform for individuals to interact with IoT objects, removing one of the main cost barriers to growth. Payment, ticketing, vouchers, and customer loyalty applications will become cheaper and easier to manage, and allow much greater sophistication in pricing, marketing, product management and analysis. One company has forecast that around $36.05bn of NFC payments will be made worldwide in 2017, although this figure has been reduced by more than 40% from previous forecasts due to slower growth than expected to date.[14]

So far, IoT technology has been most broadly used in logistics and inventory management. Retailers can track products from the factory, through distribution networks – with real-time updates to orders and routes – to warehouses, into stores, triggering replacement when taken off the shelves, enabling customer self-payment, and replacing theft and shrinkage. Customer flow can be monitored continuously, enabling better retail layout. Shoppers can also take advantage of tags, using smartphones to access online information about products from the manufacturer, retailer, independent reviewers and friends, and even make price comparisons with other retailers. Customers can be given dynamic offers and shown display advertising based on their known preferences or demographics (the latter approximately determined by camera image analysis, and more precisely using signals from wireless devices such as smartphones). The use of data about individuals raises significant questions of privacy regulation, discussed below.

Manufacturers can embed sensors throughout their production processes, enabling much more precise control and hence increased efficiency and quality, while significantly lowering waste, energy use, the risk of accidents and product damage.[15] Similar techniques can be used through the whole lifecycle of equipment, vehicles, and the built environment, allowing for just-in-time repairs that minimise downtime and cost. And farmers can use IoT systems to carefully monitor soil and crop condition, precisely adjusting planting and pesticide use to maximize yield and minimise environmental impact, and enabling better food traceability.[16]

Businesses will likely be the biggest users of IoT technologies, with one analysis estimating that by 2019 enterprises will be using 40% – 9.1 billion – of deployed devices, with the highest-spending industry sectors being manufacturing, transportation and warehousing, and information.[17] Another analysis predicts that by 2020 there will be 2.1bn machine-to-machine device connections, with two-thirds of these in utilities industries, one-fifth in security applications, and smaller numbers in the automotive and transport sector, healthcare, government, retail and financial services. Applications will spread from developed to emerging economies, from limited commercial markets to a broad spread of consumer applications.[18]

Figure 2: Popular IoT uses



Source: ITU

Figure 2 and Table 1 show the areas where IoT usage is currently receiving the most attention from key ICT stakeholders, identifying possible developments. At the macro-level, two of the areas of greatest IoT development and investment are smart cities – where infrastructure and building systems will improve the efficiency and sustainability of a whole range of urban activities – and smart power and water grids. Closer to the individual, "connected vehicles" with hundreds of separate sensors will be safer, more reliable, and able to participate in sophisticated congestion management systems. And population health and wellbeing – a challenge to governments around the world as populations grow older, with a corresponding increase in age-related chronic conditions – could be significantly enhanced with IoT-based systems used by individuals, carers, primary care doctors and hospitals.

Table 1: Overview of some key areas of applications to-date

Areas of applications	Drivers	Examples	Possible development
Smart cities	Continued urban growth, presenting quality-of-life issues. By 2023, there are likely to be 30 cities with a population of over 20 million. Over half of these will be in India, China, Russia and Latin America.[19] Large public and private-sector investments, such as Saudi Arabia's US$70bn four "economic cities" project;[20] South Africa's US$7.4 billion smart city in	Monitoring and maintaining critical infrastructure such as roads, bridges, tunnels, railways, ports, communications, water and power.[23] Doha, São Paulo, and Beijing have used water pipe and pump monitoring sensors to reduce leaks by 40-50%.[24] Networked traffic signals dynamically manage traffic	Continued deployment of sensors and metering system will enable greater city coverage and new applications, as will greater availability of communications capacity; distributed, intelligent network analytics; and platforms for small/medium-sized businesses and software developer

	Modderfontein;[21] Masdar in Abu Dhabi; Accra in Ghana; Yachay in Ecuador; plans for over 100 smart cities in India; and an US$8bn smart city technology investment fund in China.[22]	movement across a city in response to measured and predicted changes in congestion and accidents. Congestion charging systems reduce vehicle commuting time by 10-20%.[25]	interaction.[26]
Smart meters and grids	Environmental sustainability – increase energy efficiency, reduce power consumption, especially at times of peak demand. Enable consumers to better understand and reduce energy usage, and switch to suppliers offering tariffs closer to their needs. Integrate variable renewable and home energy sources into grid. Fraud and theft can be remotely detected and meters disabled.	1.1 billion smart meters estimated to be installed by 2022;[27] 80 million in Japan, hundreds of millions in EU, and 150 million in India.[28] Smart water meters can enable leak detection. Installations in the US, Malta, India and Canada found an average reduction of water usage of 5-10%.[29]	Could save 33% of the total cost of constructing a grid using traditional methods.[30] Reduce downtime and waste through better load balancing and voltage regulation, and faster detection and diagnosis of faults.
Connected vehicles	Faster and more targeted emergency response to accidents. Enable drivers to monitor their car condition and driving habits, enabling them to improve vehicle reliability and fuel efficiency, as well as keep track of journeys. Pay-as-you-drive insurance. Stolen cars can be remotely tracked and disabled. Autonomous driving.	Worldwide, the top 14 car manufacturers, which account for 80% of the global market, all have connected vehicle strategies.[31] EU is close to agreeing requirement for all new cars and small trucks sold to feature an "eCall" system from April 2018.[32]	90% of consumer cars sold in the US by 2020 estimated to have an Internet connection, an increase of over 80% since 2013.[33] Cars share congestion and road problem data, enabling other cars to avoid congestion and notify repair and emergency services of problems. More efficient insurance markets, particularly for under-served groups such as young adults.
Healthcare	Improve efficiency and care in existing healthcare settings. Enable much greater use of remote telehealth provision, with greater patient comfort and lower cost. Let individuals monitor own health, improving wellbeing by better managing conditions such as stress, encouraging exercise and healthy eating, diagnosing medical conditions more quickly, and encouraging compliance with treatment regimes.	Patients with chronic conditions such as diabetes can monitor and report warning signs, using devices such as connected insulin pumps and blood-pressure cuffs. Annual cost of chronic conditions could reach US$15.5 trillion by 2025, with remote monitoring reducing this by 10-20%.[34]	"Quantified self" systems measure heart rate, breathing, temperature, sleep and brainwaves, and apps help users record diet and alcohol intake – increasingly, linked to user's smartphone.[35] Patients can share data to reassure carers and relatives, share advice in online patient forums, and volunteer information to medical researchers

4. Challenges and opportunities

The public and private sector are continuing to fund significant levels of IoT research and development, in areas such as modularity, reliability, flexibility, robustness and scalability.[36] But the basic capabilities needed for many applications are already well understood,[37] and becoming available through smartphones and other standard platforms. These devices will also address some of the cost issues that have held back growth in the past, although cost and reliability remain issues for large-scale systems, as does connectivity.

IoT technical standards have evolved from a variety of different applications and stakeholders, who have different aims and requirements, and more work is needed to integrate different standards frameworks.

A significant opportunity is the greater use of open data, platforms, and Application Programming Interfaces (APIs), which can enable a higher level of innovation in IoT systems.

Table 2 provides an overview of the various challenges and opportunities discussed in this section. It further identifies best practices and possible way forward.

Table 2: Overview of challenges and opportunities

What?	Why?	What is done today/best practice	Possible way forward
Cost and reliability	Most tags and readers not yet cheap enough to be ubiquitous. Limited consumer use of QR codes, and perceived negative impact on aesthetics. Costs can be too high for adoption by SMEs. Very high reliability requirements in large-scale systems with thousands of tags and devices. Power sources are challenging for cheap but long-life sensors. Large investments needed to take full advantage of "smart city" systems.	Ongoing development and deployment of cheaper, more efficient and reliable hardware and protocols. Innovation centres in countries to stimulate market entry and competition. Public-private partnerships and cooperation between municipalities, businesses and contractors to reduce costs and share resources.	Standardised functions in smartphones to interact with tags and sensors, including via web browsers. Great attention to aesthetics of tags, such as dotless visual codes.[38] Further R&D in areas such as energy scavenging, low energy protocols and algorithms, and high-reliability systems.
Connectivity	Application-specific networks and components can increase costs and reduce the opportunity to improve security and reliability. Mobile data networks still adapting to support large M2M systems.	Data from disparate systems integrated at data hubs, including cloud services. Many mobile networks have M2M business units and networks, with specialised business processes including charging and system integration to support large systems. Increased 4G deployment gives high throughput, low latency option for M2M.	Additional IoT support in next-generation cellular networks. R&D of more common middleware and APIs, and further standardisation of protocols for resource-constrained systems.

Standards (from the ITU and other organisations)	Technical standards have evolved for different applications and stakeholders, so harder to make them coherent. Smaller national markets may lack scale to support development of local IoT solutions, unless they are built on international standards. Specific software often needed per-system, increasing user load. Premature standardisation can constrain innovation; but partial or late standardisation can create industry coordination problems and fragmented technology options.	ITU has Global Standards Initiative to develop IoT standards and provide "umbrella" for other standards organisations. Wider-focus IoT and application-specific standards groups and frameworks.	Further cooperation between key standards bodies such as ITU, IEEE, IETF, IoT-specific standards organisations, and industry groups such as GSMA. Governments can encourage further standardisation through standards body participation (already prioritised in China, Korea and India), R&D funding and procurement policies. Development of common user interface mechanisms, especially via web browsers.
Open data and APIs	IoT data is often held in "silos" that are difficult to integrate without time-consuming data discovery and licensing. IoT platforms can be industry and vendor-specific, limiting opportunities for SMEs and startups to participate.	City and country initiatives to provide for the sharing of information by individuals and organizations under non-proprietary, open source licences.	Further work to encourage cataloguing of and contributions to open datasets. National and local government authorities are in a key position to do this, and could collaborate through Open Government Partnership.

4.1 Cost and reliability

For IoT to become a truly ubiquitous technology, the cost of tags, sensors and communications systems needs to fall to a level where they are a very small fraction of the total cost of the objects they are attached to, with readers also easily available. And even the cheapest (printed) tags, Quick Response (QR) codes, have not yet had a high response in consumer-targeted marketing campaigns. This is partly because specific software can be needed to read the codes, which is beyond the initial motivation of some users to install, and users need to position phone cameras so the code is in focus and can be accurately read.[39] In response, companies are developing more aesthetically attractive codes that can include images, such as the "dotless visual codes" being used by Chinese e-commerce giant Alibaba to combat counterfeits.[40]

High reliability levels also become important in large-scale systems that can include thousands of sensors, devices and readers. Trials of the most important RFID standard, EPC Global, by retailers such as Walmart and Tesco, found some difficulties in detecting tags due to product orientation and the blocking effect of nearby materials.[41]

Powered tags relying on batteries must minimise energy consumption, which is encouraging further research into and development of energy scavenging, low energy protocols and algorithms.[42] An example is Bluetooth Low Energy (BLE), which is supported by new smartphones. BLE tags advertise their presence by sending out a message every second, and can operate for up to one year using a lithium coin cell battery. They currently cost under $US5, which is likely to drop further.[43] Another example is EnOcean, which is an ultra-low power wireless standard that supports energy harvesting wireless technology for smart buildings. Such sensors can be powered entirely using motion, light or temperature differences.[44]

Due to the immature and fragmented markets for many IoT services, which increase development and operational costs, a Korean government review found limited application of IoT e-government pilot projects, and a low rate of introduction of IoT services in small and medium-sized enterprises (SMEs). To encourage new businesses to develop and use IoT applications, a number of governments (including Korea, China, India and the UK) are supporting the development of IoT business incubators and innovation centres, which include platforms and testbeds for startups and SMEs. These can increase market entry and hence increase competition and reduce cost.[45]

The most ambitious smart city projects, such as India's 100 smart sustainable cities project, are spending hundreds of millions of dollars to build more liveable and sustainable communities.[46] Creating city-wide infrastructure for smart cities needs a strong commitment from local governments and other authorities, as well as large investments and strong partnerships between municipalities, businesses and contractors. Laying new fibre-optic cables to increase the communications bandwidth available for smart city applications, for example, can be done more cheaply if contractors can take advantage of shared infrastructure (such as road trenches and utility tunnels) coordinated by a local authority.

This can be particularly effective when a smart city is built on a greenfield site. The ITU-T focus group on smart sustainable cities has developed focus group specifications for multi-service infrastructure in such new-development areas. It gives the example of the new Indian city Lavasa, where a single company has been appointed to establish, maintain, and grant rights to assets such as dark fibre, rights of way, duct space, and towers, on a lease/rent/sale basis to telecom services.[47] In existing cities, deployment of systems is much more likely to be on an incremental basis.

4.2 Connectivity

For IoT system designers, there is a choice between centralised, cloud-based functionality and more distributed applications, where some data is stored and processed on or near to sensors. Centralised systems allow a small number of powerful computers to manage large numbers of cheap devices – although those devices must have a network interface that can connect to the Internet or mobile phone networks.

This configuration has advantages when large amounts of sensor data must be brought together for processing. In a more distributed system, devices can send data to smartphones or other nearby computing devices over a local radio protocol such as Bluetooth, which process data before in some cases sharing it further across a global network. This increases system responsiveness to a local user, and can provide more privacy protection to data about people – which is especially valuable for sensitive information such as health data.[48]

Some radio protocols (such as Ultra-Narrow Band) can provide longer-range coverage, which can be useful for smart city applications such as streetlight management, video surveillance and environmental monitoring. Using application-specific networks can increase costs and reduce the opportunity to improve security and reliability compared to multi-purpose networks.[49] Where mobile phone network coverage is available, 2G and 3G networks can be used by most IoT applications. The increasing coverage of 4G cellular networks provides a high-throughput and low-latency option for higher-value IoT applications such as video surveillance.

The development of 5G cellular networks, expected to be deployed in the early 2020s, will provide a number of benefits for IoT applications, especially high-bandwidth ones such as video sharing. It will bring significant improvements in wireless communications, using smart radios and spectrum sharing with 1,000 times higher spectral efficiency. It will support cooperative relays and femtocells, enabling low-power sensors to communicate further while reducing the possibility of interference between communicating devices. It will include specific features to support device-to-device communication (such as traffic offloading), and explicit support for IoT/M2M systems.[50]

Industry association GSMA identifies sub-1ms latency and >1 Gbps bandwidth as defining features of 5G, noting that many of the other goals can be met gradually using existing protocols, and that autonomous driving, augmented and virtual reality systems and tactile Internet interfaces are the main technologies today that would require such low latency and high throughput. These could be used in gaming, telemedicine and manufacturing.[51]

5G will also likely support Software Defined Networking, allowing operators to run production and test networks above physical networks, and separate IP control and data planes, increasing security, and reducing expenditures. And it could provide support for running cloud computing in core networks, hence moving analytics closer to IoT edge devices.[52] SDN and femtocells are already being deployed in some 4G networks.

Where a company such as a smart meter operator is managing thousands or millions of M2M devices via mobile data networks, they have very different requirements from a typical mobile telephone customer. They need comprehensive network status information, to determine whether a non-communicating device or its network connection is faulty. They want a single subscription for the system, not on a per-device basis. And in many cases, the intended device lifetime will be much longer than individuals typically own a mobile phone – perhaps a decade or more. Replacing a device or even communications module within it will require either an expensive service visit, or a complicated process for customers that may cause faults. Not all mobile network operators can yet cope with these requirements, although many have set up specific business units to address them.[53]

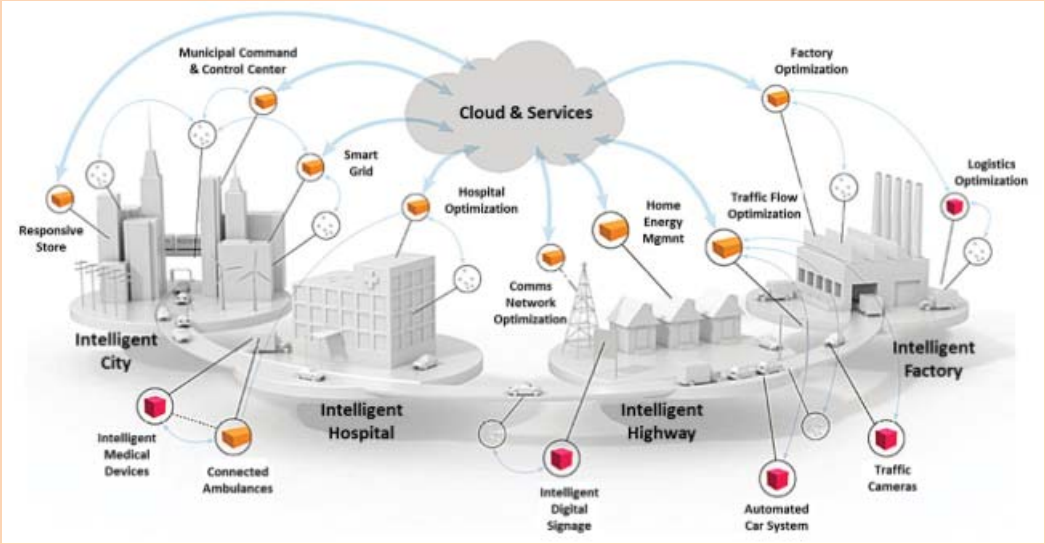
IoT systems are built on fixed and wireless communications standards, but it can still be difficult to connect together systems in different industry sectors or reuse system components. The great heterogeneity in Application Programming Interfaces and middleware (software components) makes it difficult to write applications that will run on different systems – therefore users often have to rely on a single set of applications for a single set of IoT components. More standardisation would enable more innovation, and enable information to flow between industry verticals like consumer electronics and the automotive industry. There is a need for interoperability (an issue covered further in another GSR discussion paper), connectivity, access control, service discovery, and privacy services, built on IoT-optimised protocols where necessary.[54] Greater configurability allows components to be used in a wider variety of systems, but can increase complexity and price.

Because IoT applications have strongly heterogeneous requirements, there is a need to fit different communications protocols to different applications – for example, using IoT-specific protocols such as the Constrained Access Protocol CoAP in resource-constrained systems. Most applications will be built around the Internet Protocol, except on very constrained devices. M2M devices can connect directly to other machines, but frequently there are gateways connecting IoT devices, which provide added value services such as

protocol conversion, filtering, caching; and back-end hubs – which can run on smartphones, gateways, or for global scale in the cloud.[55]

Even if integration of infrastructure and networks can prove challenging between organisations – whether public or private sector – data from disparate systems can still be integrated at data hubs, including cloud services.[56] Companies are building system frameworks to connect together disparate applications and networks via cloud services. One example is shown in Figure 3:

Figure 3: Intel's Intelligent Systems Framework



Source: Intel Corporation, Simplifying the Internet of Things: Intel® Intelligent Systems Framework, 2012.

Much of the value from IoT systems will come from integration of separate, proprietary silos, especially for large organisations with a broad range of partners – in the same way that development of shared technologies for personal computers, like operating systems and processors, enabled much greater levels of distributed innovation and consumer choice in the 1980s. Improved data sharing will also allow the development of specialised data analysis providers, who can increase the value of that data.[57] This does however depend on consumer trust in the security and privacy protection of the data (discussed further below).

4.3 Standards

To date, Internet of Things technical standards have evolved from a variety of different applications and stakeholders, who have different aims and requirements.[58] A universal and uniform network of "things" is unlikely to develop in the medium term. Smart meters are unlikely to communicate directly with heart rate monitors, or recipe planners; some networks will use public infrastructure, others will be entirely private; some applications have high bandwidth and interactivity requirements (such as video surveillance) while others may focus on transferring short bursts of information (such as smart meters). But with effective standards, these networks can be bridged.

Greater technical standardisation can both reduce the barriers to entry to IoT markets and increase economies of scale – the latter helping suppliers to compete internationally. Without this, national markets may face the issues identified in a Korean government review, where large businesses are developing IoT platforms, but lack leadership in the global market, which in turn makes it difficult for local SMEs to enter the market – and leaves them dependent on global suppliers.[59] However, the diversity of IoT systems and users means that there is a limited constituency actively pushing for standardisation.[60] Many of these users – for example in the healthcare sector – do not have a great deal of experience in communications standards bodies. Standards need to be carefully designed so they do not constrain innovation in still-young IoT markets. However, partial or too-late standardisation can complicate innovation due to industry coordination problems and fragmented technology options.[61]

In an effort to deal with these issues, the ITU-T has created a Global Standards Initiative on Internet of Things (IoT-GSI) to "promote… a unified approach in ITU-T for development of technical standards (Recommendations) enabling the Internet of Things on a global scale," and to "act as an umbrella for IoT standards development worldwide." This works with specific ITU-T IoT groups (a Joint Coordination Activity, and Focus Group on a machine-to-machine service layer), and the main ITU-T Study Groups (especially Study Groups 2, 3, 5, 9, 11, 13, 16 and 17).[62]

Other international communications standards bodies have ongoing IoT-related activities. The Institute of Electrical and Electronics Engineers (IEEE) considers IoT-related issues in a range of its communications standards, particularly 802.11 (Wi-Fi), 802.15 (Wireless Personal Area Networks), and 802.16 (broadband wireless), 802.3 (Ethernet), and 1901.2 (power line networks), as well as considering applications relating to the smart grid, energy, industrial, agriculture and mining sectors. It has created a draft standard (P2314) on an architectural framework for the IoT. The leading Internet communications standards body, the Internet Engineering Task Force (IETF), has considered IoT issues in its 6Tish (IPv6 access and meshing over deterministic (scheduled) MAC), IPv6 (Internet Protocol version 6), 6LoWPAN (IPv6 over Low power WPAN), RPL (Routing Over Low power and Lossy networks), MPL (Multicast Protocol for Low power and Lossy Networks), and CoAP (Constrained Application Protocol) working groups.[63]

There are a number of IoT-specific standardisation groups. The OneM2M group brings together manufacturers, service providers, end-users, and regional standards bodies from North America, Europe and East Asia.[64] It has developed a suite of standards for M2M and other IoT applications, including a set of security solutions.[65] Another IoT-specific group is the Industrial Internet Consortium, which includes some of the largest companies developing IoT technologies, such as AT&T, Inc., Cisco Systems Inc., General Electric, IBM, and Intel. The consortium is developing use cases, reference architectures and frameworks, and aims to influence global standards processes.[66] A third example is the AllSeen Alliance, a consortium that is developing the open source AllJoyn software and services framework. Members include consumer electronics companies such as Canon, Electrolux, LG, Panasonic and Sharp, as well as technology companies such as Microsoft and Qualcomm.[67] And the mobile industry association GSMA works with its members to drive M2M standardisation.

There are also IoT application-specific standards frameworks, such as the M/490 Smart Grid reference architecture, which can be reused in other IoT domains. This was created

following a specific mandate from the European Commission to European standards organisations, principally ETSI, CEN and CENELEC. These standards bodies are able to create standards that can be referred to by EU Regulations and Directives – one example of a mechanism by which policymakers can incentivise the creation and use of specific technical standards.[68] Another is for governments to support the development of standards and products implementing them using research and development funding, and prioritising the use of such products in government-funded programmes. Without such incentives, it can sometimes be in the interests of large companies to attempt to create their own proprietary *de facto* standards as barriers to entry to competitors.[69]

Many IoT systems will require very limited human interaction – for example, an on/off switch, or a bus stop notifying passengers of the time until the next bus arrival. Requiring a separate smartphone app or other type of software to interact with such systems will be an unnecessary burden for users. One suggestion for standardising the user interface to these systems is that they locally broadcast a Uniform Resource Indicator (URI), which is currently most commonly used to identify web pages. Other smart devices in range can then list and interact with such devices, via a web browser or more specialised software.[70]

4.4 Open platforms, data and APIs

A mechanism for encouraging much greater analysis and integration of IoT data is for individuals and organisations to share information under non-proprietary, open source licences. This makes it available for new applications without the need for time-consuming data discovery and licence negotiation.

One example is Amsterdam's Open Data programme, which has catalogued 438 datasets about the city.[71] Partners contributed to and analysed these datasets – including by designing a sensor to enable individuals to monitor and share pollution, noise and light intensity data from their neighbourhood. Amsterdam is also one of eight cities participating in a CityService Development Kit (CitySDK) project,[72] which lets programmers write software that can access data and shared IoT services via open Application Programming Interfaces (APIs) – such as services to improve transportation, help report problems to the city council, and guide tourists around places of interest.[73]

As part of the Amsterdam initiative, a number of "Living Labs" have been set up in communities to experiment with smart city initiatives, identifying successful ideas so they can be implemented across the city. An example is in IJburg, which has "projects like free Wi-Fi and a new Fiber network, personalized television and transportation services, and a co-working space allow residents to experiment and test city projects to improve healthcare, environment, and energy programs in the city."[74]

Another example of the use of open source approaches is in the Korean government's IoT master plan. The government will collaborate with the private sector to develop an open IoT platform, and all ministries will be encouraged to collaborate with businesses across the entire country. This will stimulate an open IoT ecosystem, which is intended to improve interoperability, reduce costs through economies of scale and scope, and enable flexible responses to environmental changes. A test-bed for small and medium-sized enterprises will reduce development costs and time-to-market, and support collaboration between businesses in different areas. The ecosystem will support startups to turn ideas into

businesses, using tools including open source hardware (circuit diagrams, board plans, and specifications required for hardware development) and software, and DIY open labs.

5. Policy and regulatory implications and best practices

The deployment of IoT systems, and their potential impact on individuals and businesses, raises regulatory issues – some familiar to telecoms regulators, such as licensing, spectrum management, standards and competition, and others where a lead is often taken by other regulators, such as data protection, privacy and security.

A 2013 European Commission consultation exercise found a diversity of views on whether IoT-specific regulation is necessary. Industry respondents argued that state intervention would be unwise in this still-young sector, and that general rules such as the EU's forthcoming Data Protection Regulation will suffice. Privacy advocacy groups and academics responded that IoT-specific regulation is needed to build public confidence, as well as to ensure a competitive market.[75] Meanwhile, an FTC staff report suggested that IoT-specific legislation would be "premature". It instead encouraged self-regulatory programs for IoT industry sectors to improve privacy and security practices – while also reiterating the FTC's previous call for "strong, flexible, and technology-neutral federal legislation" to strengthen its ability to enforce wider data security standards and require consumer notification following a security breach, and for broad-based privacy legislation.[76]

This section reviews actions taken by regulatory agencies that will enable the development and adoption of IoT systems in a way that maximizes their societal benefit (see Table 3).

Table 3: Overview of policy and regulatory measures taken

What?	Why?	What is done today/best practice
Licensing and spectrum management	Ensure spectrum is available for a wide range of IoT applications, at short and long range, in licensed and unlicensed bands.	Monitor availability of spectrum for short and long-range IoT communications and backhaul network capacity, and encourage 4G deployment and use of small-cell technology.
Switching and roaming	Standard mobile telephony network SIMs and accounts unsuitable for large M2M users, mobile devices, and fixed devices in areas of poor reception.	Mobile network operators develop M2M-specific business units with appropriate billing and management. Further development and deployment of embedded, remotely provisioned SIMs in M2M systems.
Addressing and numbering	Very large address space needed for globally addressable things.	Deployment of IPv6 by ISPs, public and private sector organisations. Use of IMSI for M2M applications.
Competition	Some market configurations of IoT services could strengthen position of large firms and increase potential for consumer lock-in. Limited user access to raw IoT data reduces ability to switch providers (and to understand privacy implications).	Ensure competition regulators have capability to monitor IoT markets for abuses of dominant positions. Provide institutional mechanism for ongoing review of laws and regulations for impact on IoT competitiveness.
Privacy and security	Security vulnerabilities in IoT systems let attackers access private data and cause physical harm in cases such as medical devices and connected vehicles. Many IoT companies have little Internet	Ensuring security and privacy from outset of IoT system design process. Development of co-regulation by all stakeholders to protect security and privacy. Further development of privacy and

	security expertise. IoT device resource and connectivity constraints make security and vulnerability patching more difficult. Smart city vulnerabilities can be hard to fix but present significant safety issues (e.g. in traffic lights). Innocuous sensor data can be linked together to create detailed individual profiles, and used to infer sensitive personal information, such as medical disorders. This may lead to discrimination in employment, financial and healthcare services.	consumer protection rules to ensure security testing of IoT systems that process sensitive personal data.

Box 2 describes one notable example, India's programme to develop 100 smart cities and highlights a number of policy and regulatory issues raised by the Telecom regulator, TRAI.

Box 2: India's smart cities programme

India is continuing its rapid pace of urbanization, and expects its urban areas to contribute almost 75% of GDP within 15 years. To improve efficiency, employment opportunities and quality of life, the government has embarked on a programme to create 100 smart sustainable cities (SSCs), consisting of 80% public-private partnership and 20% public-funded basic infrastructure.

"Smart" services will include transport, building planning, water supply, solid waste management, sewerage and sanitation, electricity, Wi-Fi connectivity, health care and education, with a total investment of USS113bn over 20 years. They will be built around an Internet Protocol core network, broadband access network, building sensing and analytical capabilities, and provide e-services to citizens. Shared infrastructure will include Wi-Fi in all public places; and small cell deployment for high speed/capacity links.

TRAI, India's telecoms regulator, has identified a number of policy and regulatory issues raised by SSCs. These include how to encourage sharing of common assets and resources; ensuring spectrum availability for reasonable quality of service, and avoiding electromagnetic frequency issues with large-scale wireless sensor deployment; identifying and developing open standards, especially to enable operability between sectors; data security; a numbering and addressing plan, including customer addresses for M2M devices; and security and lawful interception for M2M devices.

Source: Telecom Regulatory Authority of India, Smart Sustainable Cities - Policy and Regulatory Issues for India, 2015.

5.1 Licensing and spectrum management

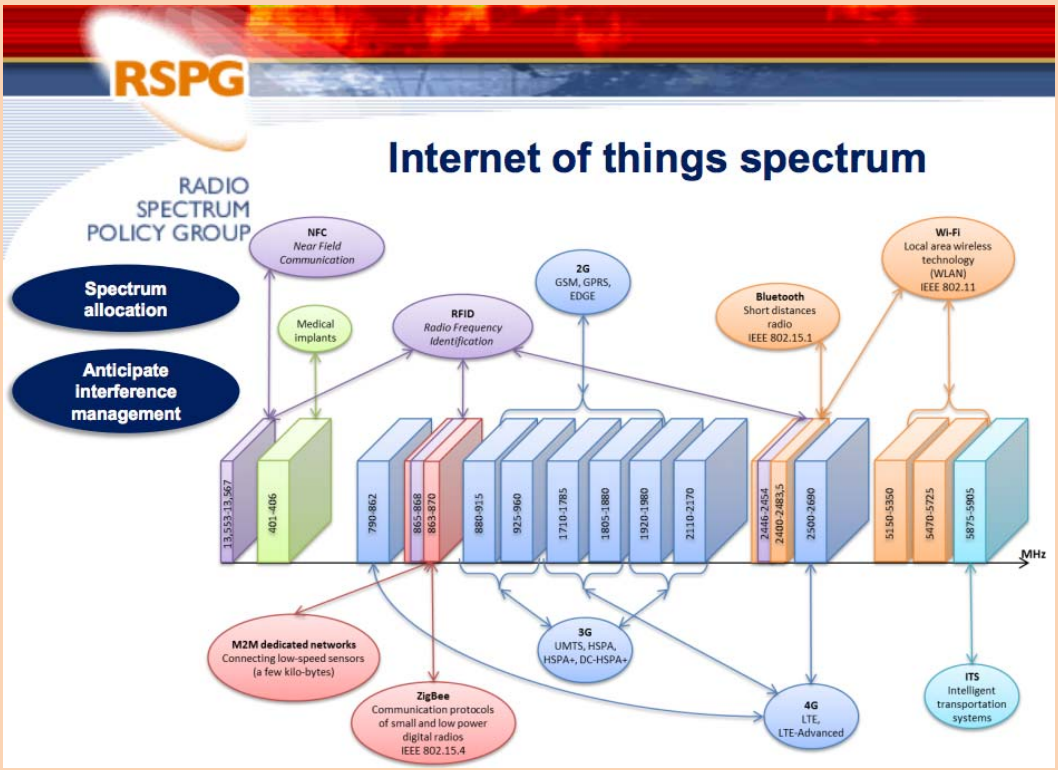
Licensing and spectrum management is an important issue for ensuring availability and capacity for IoT communications. IoT devices communicate using a range of different protocols, based on their connectivity requirements and resource constraints. These include short-range radio protocols such as ZigBee, Bluetooth and Wi-Fi; mobile phone data networks; and in more specialised applications such as traffic infrastructure, longer-range radio protocols such as Ultra-Narrow Band (UNB).

To communicate to remote networks, IoT devices may send data via a gateway with a wired (PSTN, Ethernet, power line or DSL) or wireless (2G, 3G, 4G/LTE or UNB) connection to the global Internet or telephony network – or directly over one of these mediums.[77] For

consumers, the gateway will often be a smartphone or home wireless router. Businesses will frequently make use of their existing corporate data networks.

Devices communicating over kilometres need access to the 300 MHz to 3GHz spectrum area, while centimetre or millimetre contactless transactions may use near field communications at 13 MHz or EHF bands (as shown in figure 4). Some IoT applications may also make use of AM/FM bands in the VHF range. Telecommunications companies are experimenting with white space spectrum to make more use of often-unused spectrum bands, while a US presidential commission has recommended the development of shared-space technology that enables government, licensed commercial users, and unlicensed users to cooperatively make use of a large amount of spectrum.[78]

Figure 4: IoT spectrum



Source: Radio Spectrum Policy Group.

The US Federal Communications Commission (FCC)'s expert IoT working group predicts IoT will add significant load to existing services such as Wi-Fi and 4G mobile networks. Regulators will need to give continuing attention to the availability of spectrum for short-range IoT communications, and the capacity of backhaul networks that connect IoT gateways to the Internet, as well as encouraging the roll-out of small cell technology such as 4G. If these conditions are met, the working group does not expect that new spectrum will need to be explicitly allocated to IoT communications.[79]

The FCC is also reviewing the use of spectrum above 25 GHz for 5G networks, and possibly the IoT.[80] The Korean government plans to secure additional frequency of at least 1GHz by

2023 and ensure 5G is commercialised by 2020 in response to the "exponential growth" it expects in IoT traffic.[81]

Studies for the European Commission have suggested that a licence exempt model is most effective for IoT development, since it avoids the need for contractual negotiations before devices are manufactured and used, allowing the production of large numbers of cheap devices.[82] Most current systems use unlicensed frequencies in the Industrial, Scientific and Medical (ISM) bands, including sub-kHz for video surveillance and access control, the Medical Implant Communications Service (MICS) in the 400 MHz band, and 900 MHz for the EPC RFID standard. The generic Bluetooth, ZigBee and Wi-Fi standards also work in unlicensed spectrum.[83]

One example of a specific long-distance IoT-focused communications system, SIGFOX, uses the most popular European ISM band (the ETSI and CEPT-defined 868MHz) and the FCC-defined 902MHz band in the USA.[84] A Korean government review found an increasing demand for unlicensed, low-power, long distance communications to connect devices in remote areas.[85]

5.2 Switching and roaming

Firms operating large networks of M2M devices via mobile telephony networks, with a fixed SIM in each device, may not find it easy to switch network at the end of a contract, or if a device roams into a different network area or for some time period could get better service from a different provider. This roaming capability is important for devices that move between countries, and also for fixed location devices that may be used in an area of short or long periods of service unavailability – often indoors.[86]

Some technical standardisation work has been done to enable such services, with some of Apple's latest iPads including SIMs that make it easier for users to switch between mobile networks, and leading SIM supplier Gemalto supplying reprogrammable SIMs for smart watches. The first steps have been taken in this direction in the Netherlands, which in 2014 allowed SIMs to be issued by organisations other than mobile network operators, such as utilities and car companies.[87] The GSMA has developed standards for remote M2M device management, which are being supported by mobile operators including China Unicom and Telefónica.[88]

Greater flexibility and competition would be possible if large IoT operators were able to act similarly to mobile virtual network operators – not least because they could then have wholesale access to mobile networks.[89] The German network regulator *Bundesnetzagentur* consulted on the market for IMSIs in late 2014.[90] An OECD analyst estimated that if German carmakers were able to issue their own SIMs and rent spare capacity on mobile networks, they could save US$2.5 billion per year through lower prices and more flexible contracts.[91] The Belgian communications regulator BIPT is also consulting on the national number plan.[92]

The European Conference of Postal and Telecommunications Administrations (CEPT) Electronic Communications Committee has recommended that SIMs whose IMSI can be remotely updated should be implemented as soon as possible, and that CEPT countries consider great flexibility in assigning Mobile Network Codes (MNCs) to IoT service providers. It has also encouraged the ITU-T to consider updating Recommendation E.212 to explicitly

allow this flexibility, as well as to plan for the future use of MNCs to support a broader range of services.[93] These changes have been under consideration in ITU-T Study Group 2.

5.3 Addressing and numbering

IoT devices may have a globally unique and routable communications address (requiring a very large protocol address space, such as that of IPv6); an address assigned by a gateway that allows limited inter-network connectivity; or make use of local networks only, to share data with and receive instructions from a nearby controller, such as a personal computer, smartphone, or specialised management device – in which case a globally-unique address is not required.

Enabling peer-to-peer connections between devices can increase the reliability of communications, compared to requiring a large and complex global network, and matches the common use case of an individual discovering and interacting with nearby devices. But where devices must be globally reachable – most likely, via the Internet – a large address space is required to individually identify each one.

The number of unallocated addresses for the current version of the Internet Protocol (IPv4) is extremely limited, but the new version (IPv6) being rolled out by ISPs around the world has enough addresses for almost any conceivable number of devices.[94] The transition from IPv4 to IPv6 has taken longer than expected, and policy makers may need to continue with programmes to encourage the transition in the medium term. The US government, for example, set up a Federal IPv6 Task Force to move all federal agencies from IPv4 to IPv6, with one aim being to encourage the private sector to do the same. Many other countries have also set up IPv6 Task Forces to encourage national transitions.

For any IoT identification scheme, there will be trade-offs between performance, scalability, interoperability, efficiency, privacy preservation, ease of authentication, reliability, flexibility, extensibility, and mobility support. As well as IPv6 addresses, the other main identification standards being developed are from ISO and GS1, as well as ITU-T Recommendation E.212 for the use of the International Mobile Subscriber Identifier (IMSI) for machine-to-machine communications.[95] The latter has the advantage of a well-developed authentication, payment and global roaming framework, operated by mobile telephony providers, with hardware security based on SIMs.

5.4 Competition

IoT technologies will likely have a range of impacts on the competitiveness of different markets. In the short term, firms adopting IoT systems will have better information on their business processes, enabling an increase in efficiency and more flexible responses to supply, processing and demand shocks. This could strengthen the market position of larger firms that have greater access to capital (to build their own IoT infrastructure) or brand loyalty (to increase sales volume to cover the price of third-party IoT services). For products with network effects (the purchase of a product increases its value to existing purchasers – for example, telephone service, where a new customer can call and be called by all existing customers), greater sales volumes can increase the likelihood of consumers being locked in to existing suppliers[96] – especially if the supplier uses non-standard interfaces and sells complementary services.

Over time, if IoT technology is adopted in ways that require high capital spending, increase firms' pricing power, or strengthen network effects, then adopters can drive out competitors. Market structure will also be affected if large companies can build their own IoT systems but smaller companies have to subscribe to them, or connect to networks of larger firms. If a "core" of large businesses adopt IoT, this could increase competition between them while reducing competition between core and peripheral firms. This could benefit consumers by turning quality-based competition into price competition. But if firms feel they have to adopt IoT simply because competitors have, this could lead to overinvestment by incumbent firms and reduced entry into those markets by firms not willing to make this investment.[97]

An important aspect affecting competitiveness of IoT systems in the longer term is the extent to which end-users can gain access to the raw data gathered and stored by components. Systems usually extensively process sensor data so that it is more useful when presented to users. While this makes systems more user-friendly, it reduces the ability of users to transfer data to different providers if a better service is offered (as well as to understand what inferences could be drawn about them from the data).[98] It also makes it more difficult for end-users to combine systems from different providers – which could become a competition issue if a provider becomes dominant in one area, and tries to extend that dominance into other areas by blocking interoperability with competitor systems.

One example of regulatory activity to promote competition is Korea, where the government's Telecommunications Strategy Council has been given responsibility to adapt existing laws and regulations to ensure a liberal and competitive industrial environment for IoT. Where the Council finds regulations that hinder ICT convergence, it can request related ministries to improve these regulations. For new products and services, attention will be given to prompt processing and interim licensing.[99]

At this relatively early stage of IoT market development, it is not clear whether it will support "more than a relatively small number of very large players", as is the case with existing Internet markets such as search and advertising. Competition regulators will need to keep under review whether *ex post* investigations of abuse of dominant positions will be sufficient to foster a competitive market and rapid innovation, including the ability of start-ups and individual entrepreneurs to create new products and services.[100]

5.5 Privacy and security

Privacy and security are two significant (and closely related) issues in large-scale IoT deployment. There are already technologies available that address some of the underlying technical issues, particularly in sensors – such as key diversification and reader authentication. But these can have a significant impact on device size, cost, functionality and interoperability.[101]

Without adequate security, intruders can break into IoT systems and networks, accessing potentially sensitive personal information about users, and using vulnerable devices to attack local networks and devices. This is a particular issue when devices are used in private spaces, such as individuals' homes, for example with baby monitors. The operators of IoT systems, and others with authorised access to the data produced, are also in a position to "collect, analyze, and act upon copious amounts of data from within traditionally private spaces."[102]

Electronic attacks could also lead to threats to physical safety, for example if carried out against medical devices like pacemakers and insulin pumps, or car engines and brakes. Information about building occupancy could be used by burglars to target unoccupied premises, while location-tracking data might enable physical attacks against specific individuals.[103]

If compromised IoT devices can connect to systems elsewhere on the Internet, this provides a potential route for further attacks. One security company announced in 2014 it had discovered hundreds of home devices – including smart fridges – sending unsolicited e-mail. While a further analysis found this to be inaccurate, it also warned of recently discovered malicious software targeting Linux-based IoT devices.[104] Another common security and privacy issue is the use of default passwords on devices, which users are not required to change when setting up a device. One website has claimed to find 73,000 webcams accessible over the Internet using a default, known, password.[105]

IoT devices can be harder to secure than personal computers. Many companies building IoT devices do not have previous experience of dealing with Internet security issues in their products. IoT devices are often inexpensive and resource-constrained (notably on power and battery life), which puts strong pressure on security costs and additional hardware or software to deal with threats. Combined with the limited Internet connectivity of some devices, this may make it more difficult to develop and apply regular security patches when vulnerabilities are discovered – and for companies to afford ongoing support.[106] But most IoT devices contain multipurpose computers and can be reprogrammed beyond their intended purpose – with limited mechanisms for users to monitor the device. And they frequently share operating systems, embedded chips and drivers, meaning that a single vulnerability can often be used to attack a wide variety of devices.[107]

In large IoT systems such as smart cities, IoT insecurity can create significant vulnerabilities, and be extremely complex to address given interdependencies and links to older public and private sector systems. One 2014 threat assessment found 200,000 vulnerable traffic control sensors in cities including Washington DC, New York, Seattle, San Francisco, London, Lyon, and Melbourne. The assessment also found such vulnerable technologies being developed and used in critical infrastructure without security testing, and that it can be difficult for third-party security researchers to gain access to devices to carry out their own tests, due to their expense and limits on sales to governments and specific companies.[108]

Companies developing and operating IoT systems will need to conduct security testing, and consider how security vulnerabilities discovered after devices are sold can be fixed during their likely lifetime. Where security flaws cause consumer harm, consumer protection agencies may be able to take action to require those harms be remedied, and better security processes be put in place to reduce the risk of them recurring.[109] EU rules require organisations processing personal data from IoT systems to carry out security assessments, and make use of relevant security certifications and standards.[110] And companies need to ensure that where they use external service providers to manage IoT devices and data, those providers also take reasonable security precautions.

To meet these security and privacy challenges, regulators have suggested that companies developing IoT devices should follow a security and privacy “by design” approach, building security and privacy functionality into the device from the outset of the development process, when it is much more likely to be effective.[111] The 2014 international conference of

privacy regulators declared that this "should no longer be regarded as something peculiar. [It] should become a key selling point of innovative technologies."[112] That said, there is so far little evidence of market demand for privacy-friendly services – partly because of the difficulties for individuals in assessing and weighing up complex privacy risks. And while regulators have been discussing privacy by design for over a decade, the specifics of implementation have so far only been developed to a limited extent.[113]

Companies can undertake Privacy Impact Assessments when designing IoT systems, to consider how different design options have different privacy effects. This can also reduce the risk of the need for expensive delays and redesigns of systems that are found to be non-compliant with privacy rules – as was extensively debated during the development of the Netherlands' smart meter programme.[114]

A significant amount of work has already been done on security and privacy issues by policymakers and regulators in the EU and USA. Under the General Data Protection Regulation being debated in the European Parliament and Council of Ministers, there will be stronger regulatory incentives for companies developing systems that process personal data to protect security and privacy by design. The US Federal Trade Commission (FTC) also suggests companies follow a "defence in depth" approach, considering security measures at several different points in their systems, such as using access control measures and encrypting data even when users are making use of encrypted links to home Wi-Fi routers (which will not protect the data between the router and the company's servers, or if the router is badly configured).[115]

Privacy is a particularly strong regulatory issue in European countries, where it is included in a comprehensive legal framework that includes the Council of Europe's European Convention on Human Rights and Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data, and the EU Charter of Fundamental Rights. This framework has been influential in the development of comprehensive privacy laws now in force in over 100 countries around the world.[116]

The EU already has a very detailed legal framework regulating the public and private sector's use of personal data, with a general Data Protection Directive (95/46/EC) relevant to IoT device manufacturers, social media platforms and app developers that access IoT data; and an e-Privacy Directive (2002/58/EC) also relevant to IoT device manufacturers.[117] The European Commission has already sponsored a process to create an RFID privacy code of practice, developed collectively by industry and civil society and approved by the EU's data protection authorities.[118]

These authorities have issued a detailed opinion on the implications of the Internet of Things for privacy protection. They note the IoT produces high-volume flows of personal data that could present challenges to traditional data protection regulation – for example, since individuals will not necessarily be aware when data is shared, or able to review this data before it is sent to other parties, creating a risk of self-exposure and lack of control.[119]

A further privacy issue is the amount of personal information that can be derived from seemingly innocuous sensor data, especially when it is combined with user profiles and data from other sources. As European privacy regulators noted, "Full development of IoT capabilities may put a strain on the current possibilities of anonymous use of services and generally limit the possibility of remaining unnoticed."[120] Smart meter data, for example, can

be surprisingly revealing of individuals' day-to-day activities – down to the detail of which programmes are being watched on a television.[121] Researchers have found that smartphone sensor data can be used to infer information about users' personality types, demographics, and health factors such moods, stress levels, smoking habits, exercise levels and physical activity – even the onset of illnesses such as Parkinson's disease and bipolar disorder.[122]

This kind of information has obvious applications, such as in pricing health insurance; but also for other decisions related to employment, credit and housing. This could lead to economic discrimination against individuals classified as poor credit and health risks, and potentially to "new forms of racial, gender, or other discrimination against those in protected classes if Internet of Things data can be used as hidden proxies for such characteristics."[123]

To protect individuals' privacy, the FTC has suggested that notice and consent be required when personal data is collected by IoT applications outside the reasonable expectation of consumers, based on the context of transactions and companies' relationships with consumers. Similarly, the EU data protection authorities have noted that IoT data collected for one purpose may be analysed and matched with other data, leading to a range of secondary purposes – which should be compatible with the original purpose of collection and known to the user (this is known as purpose limitation).

IoT data collection and analysis could particularly affect privacy when it includes data from private spaces like homes and cars, and even make it difficult for individuals to go about their daily life in the largely anonymous way they took for granted.[124] When IoT applications process personal data that can reveal "sensitive" data under EU data protection law – racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, health or sex life – explicit consent is required from the individual concerned.[125] Under EU law, individuals must be able to withdraw their consent to all or specific data processing at any time, without "any technical or organisational constraints or hindrances" using tools which are "accessible, visible and efficient."[126]

A range of mechanisms could be used to obtain consent, including choices at point of sale or device setup; QR codes or barcodes on a device that could take a user to a website; privacy dashboards, for example in smartphones; and by learning from consumer behaviour, such as through privacy preferences set on other related devices.[127]

Data minimisation remains an important privacy-protective principle for consumer IoT devices, limiting the amount of personal data collected or retained, and hence reducing risks from data breaches and use of the data in ways not expected by consumers. The FTC foresees more flexibility for IoT services in collecting data not initially required to provide a service, while under stricter European rules the EU data protection authorities "cannot share this analysis".[128]

Table 5 below identifies possible measures regulators can consider to foster development of the IoT.

Table 5: Potential regulatory measures

	Potential regulatory measures
Licensing and spectrum management	Further experimentation with use of white space and shared-space technology. Encourage development of LTE-A and 5G networks, and keep need for IoT-specific spectrum under review.
Switching and roaming	Global agreement on updated E.212 standards, making appropriate use of GSMA standards, and provision of Mobile Network Codes to IoT service providers.
Addressing and numbering	Universal IPv6 adoption by governments in their own services and procurements, and other incentives for private sector adoption.
Competition	Consider measures to increase interoperability through competition and consumer law, and give users a right to easy access to personal data. Support global standardisation and deployment of remotely provisioned SIMs for greater M2M competition.
Privacy and security	R&D on more hardware and software security and privacy mechanisms for resource-constrained IoT systems, particularly targeted towards start-ups and individual entrepreneurs that lack resources to easily develop this functionality. Incentives for companies to develop new mechanisms to improve transparency of IoT personal data use, and for gaining informed consent from individuals concerned when sensitive data is gathered or inferences drawn. Greater use of Privacy Impact Assessments by organisations building and configuring IoT systems. Development of further guidance from global privacy regulators on application of the principles of data minimisation and purpose limitation in IoT systems. More cooperation between telecoms and other regulators such as privacy/data protection agencies.

6. Conclusions

While it is difficult to make precise forecasts about the global impact of the Internet of Things, analysts seem almost unanimous that it will be extremely significant – with tens of billions of devices deployed, and trillions of dollars of annual impact within the next decade. IoT technologies could make an important contribution to global challenges such as improving public health and quality of life, moderating carbon emissions, and increasing the efficiency of a range of industries across developed and developing economies.

The pace of IoT deployment will partly depending on meeting the challenges currently facing the development of cheaper, more reliable, well-connected systems. Common networks, technical standards, system components, and infrastructure, as well as strong public-private partnerships, can reduce the costs of IoT systems. Open data and platforms can make it easier for new systems to be developed, especially by individual entrepreneurs, start-ups and SMEs. Innovation centres and incubators can further encourage new businesses to enter IoT markets, increasing competiveness. Governments can take further steps to encourage national transitions to IPv6, updating all their own systems and providing incentives to private sector providers to do so, hence ensuring addresses are available for all IoT devices that connect directly to the Internet.

Large-scale IoT systems like smart cities and international logistics chains need very cheap sensors that can last for long periods of time without needing repairs or new power sources, as well as the bandwidth to share data – whether infrequent bursts, or streams of high-

resolution video. M2M systems need continued growth in coverage of 3G and 4G networks, and support for remotely provisioned embedded SIMs for more reliable and competitive communications.

This is the area where telecoms regulators can have the greatest impact, by supporting the continued development and deployment of high-speed cellular networks, and keeping under review the need for IoT-specific spectrum. Decisions on licensing and spectrum management are important to ensure IoT systems can be developed cost-effectively, and have the necessary bandwidth to communicate. By agreeing updated standards (such as the ITU's Recommendation E.212) and providing Mobile Network Codes to M2M service providers, better services could be provided at a significantly lower cost. In the long run, shared-space technology has the potential to offer much greater bandwidth for IoT and other communications services.

The widespread use of common technical standards will be key to a low-cost, interoperable IoT, and can be encouraged by continued cooperation between standards bodies, and government support for standards use and participation. National and local government authorities can stimulate the availability of open IoT datasets, platforms and components. Municipal governments are playing a key role in smart city and open data programmes, and can find it easier to experiment with new technologies and policies suited to local conditions than national governments.

Some countries are taking a relatively hands-off approach to IoT regulation, with the focus of promoting economic growth and innovation. For example, the Korean government has recently planned to reduce IoT (as well as e-commerce and Internet finance) regulation to support a dynamic ecosystem for future growth, while still protecting users, preventing abuse of market dominance and protecting Internet networks, and will decide on which restrictions to maintain through social consensus.[129] Other countries and regions – notably the European Union – are taking a more pro-active approach to protect social values such as privacy as the IoT develops, while still paying strong attention to the need to promote the economic benefits of the technology. Such strategic decisions are political ones that can only be taken by national governments, while sharing evidence and best practice through international forums such as the ITU.

Regulators can play a role in encouraging the development and adoption of the IoT, while promoting efficient markets and the public interest. Competition regulators will need to keep under review whether *ex post* investigations of abuse of dominant positions will be sufficient to foster a competitive market and rapid innovation. Particular attention will be needed from regulators to IoT privacy and security issues, which are key to encouraging public trust in and adoption of the technology. While many telecoms regulators already have responsibility for network security, this is an area where they could do more by cooperating with national privacy and consumer protection regulators to encourage development of a trustworthy IoT.

References

[1] The author is grateful for suggestions and comments on earlier drafts by Rudolf van der Berg, Mailyn Fidler, Simon Forge, Ben Hawes, Gilad Rosner, and ITU staff.

[2] Cisco Systems, *Internet of Things Connections Counter*, at http://blogs.cisco.com/news/cisco-connections-counter

[3] Gartner, *Forecast: The Internet of Things, Worldwide, 2013*, at https://www.gartner.com/doc/2625419/forecast-internet-things-worldwide-

[4] J. Manyika, M. Chui, J. Bughin, R. Dobbs, P. Bisson and A. Marrs. *Disruptive technologies: Advances that will transform life, business, and the global economy*, McKinsey Global Institute, May 2013, p.51.

[5] J. Bradley, J. Loucks, J. Macaulay and A. Noronha, Internet of Everything (IoE) Value Index, *Cisco White Paper*, February 2013, at http://www.cisco.com/web/about/ac79/docs/innov/IoE-Value_Index_White-Paper.pdf

[6] International Telecommunication Union – Telecommunications Standardization Sector, *Overview of the Internet of things*, Recommendation ITU-T Y.2060, June 2012, s.I.1.

[7] ITU-T Recommendation Y.2060, note 6, s.8.4.

[8] GMSA, *Understanding 5G: Perspectives on future technological advancements in mobile*, December 2014, p.10, at https://gsmaintelligence.com/research/2014/12/understanding-5g/451/

[9] GMSA, note 8, pp.7-10.

[10] Sasu Tarkoma, *Evolution of Internet based applications: Internet of Things, 5G and smart devices*, Helsinki public lecture, 3 April 2014, at http://livestream.com/ITstriimIT/Hetky-THkerho--IoT-5G/videos/46998469

[11] ITU-T Recommendation Y.2060, note 6, s.I.1.2.

[12] M. Malone. Did Wal-Mart love RFID to death? *Smart Planet*, 14 February 2012.

[13] J. Esmeijer, A van Veenstra, T. Bakker, A. van Nunen, B. Kotterink and M. Ooms. *New sources of growth: Knowledge-based Capital*, OECD, 2015.

[14] Gartner. *Forecast: Mobile Payment, Worldwide, 2013 Update*, 4 June 2013.

[15] M. Chui, M. Löffler and R. Roberts. The Internet of Things. *McKinsey Quarterly*, March 2010, pp.1-9, at http://www.mckinsey.com/insights/high_tech_telecoms_internet/the_internet_of_things

[16] Esmeijer et al., note 13.

[17] Business Insider Intelligence Estimates, 22 Dec. 2014, at http://uk.businessinsider.com/the-enterprise-internet-of-things-market-2014-12

[18] S. Hilton, *Imagine an M2M world with 2.1 billion connected things…* Analysys Mason, 27 January 2011.

[19] Frost & Sullivan, *Mega Trends: Smart is the New Green*, at http://www.frost.com/prod/servlet/our-services-page.pag?mode=open &sid=230169625

[20] Cisco Internet Business Solutions Group, *Saudi Arabia Invests US$70 Billion in Economic Cities Project*, July 2009, at https://www.cisco.com/web/about/ac79/docs/success/Saudi_Arabian_General_Investment_Authority_SAGIA_Engagement_Snapshot.pdf

[21] NewsCentral Media, PCCW to connect Modderfontein 'smart city', *TechCentral*, 22 April 2014, at http://www.techcentral.co.za/pccw-to-connect-modderfontein-smart-city/47706/

[22] Kieron Monks, Wire the desert: The next generation of smart cities, *CNN*, 18 December 2014, at http://edition.cnn.com/2014/12/18/business/smart-cities-next-generation/

[23] Robert E. Hall, The Vision of a Smart City, *2nd Life Extension Technology Workshop*, Paris, 28 September 2000, p.2, at http://ntl.bts.gov/lib/14000/14800/14834/DE2001773961.pdf

[24] Manyika, Chui, Bughin, Dobbs, Bisson and Marrs, note 4, p.57.

[25] Manyika, Chui, Bughin, Dobbs, Bisson and Marrs, note 4, p.56.

[26] S. Mitchell, N. Villa, M. Stewart-Weeks and A. Lange. *The Internet of Everything for Cities: Connecting People, Process, Data, and Things To Improve the 'Livability' of Cities and Communities*, Cisco Systems, 2013.

[27] Navigant Research, *The Installed Base of Smart Meters Will Surpass 1 Billion by 2022*, 11 November 2013, at http://www.navigantresearch.com/newsroom/the-installed-base-of-smart-meters-will-surpass-1-billion-by-2022
[28] Navigant Research, Smart Electric Meters, *Advanced Metering Infrastructure, and Meter Communications: Global Market Analysis and Forecasts*, November 2013, at http://www.navigantresearch.com/research/smart-meters
[29] Manyika, Chui, Bughin, Dobbs, Bisson and Marrs, note 4, p.57.
[30] GB Smart Grid: a race worth winning?: a report on the economic benefits of smart grid, Ernst & Young, 2012, https://www.smartgrid.gov/sites/default/files/doc/files/Smart_Grid_Race_Worth_Winning_Report_on_Economic_Benefits_201209.pdf
[31] Verizon, The Internet of Things 2015, p.6, at http://www.verizonenterprise.com/resources/reports/rp_state-of-market-the-market-the-internet-of-things-2015_en_xg.pdf
[32] European Parliament Internal Market and Consumer Protection Committee, *MEPs back deal with Council on automatic emergency call system for cars*, 4 December 2014.
[33] FTC Staff Report, *Internet of Things: Privacy & Security in a Connected World*, January 2015, p.1, at https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf
[34] Manyika, Chui, Bughin, Dobbs, Bisson and Marrs, note 4, p.54.
[35] Counting every moment, *The Economist*, 3 March 2012, at http://www.economist.com/node/21548493/
[36] See e.g. the European Commission's Horizon 2020 research programme.
[37] European Commission, *Internet of Things in 2020: Roadmap for the future,* 27 May 2008, p.13.
[38] Davey Alba, Alibaba Reveals a New Kind of QR Code to Fight Counterfeits, *Wired*, 18 May 2015, at http://www.wired.com/2015/05/alibaba-reveals-retro-way-fight-counterfeits-qr-codes/
[39] Roy Want, Bill N. Schilit, and Scott Jenson, Enabling the Internet of Things, *IEEE Computer*, Jan. 2015, p.31.
[40] Alba, note 38.
[41] Want, Schilit, and Jenson, note 39, p.30.
[42] Ovidiu Vermesan and Peter Friess (eds.), *Internet of Things – From Research and Innovation to Market Deployment*, Aalborg: River Publishers, 2014, p.45.
[43] Want, Schilit, and Jenson, note 39, p.32.
[44] EnOcean Alliance, EnOcean Wireless Standard ISO/IEC 14543-3-10: The interoperable wireless standard for home and building automation, at https://www.enocean-alliance.org/en/enocean_standard/
[45] Republic of Korea Ministry of Science, ICT and Future Planning, *Master Plan for Building the Internet of Things (IoT) that leads the hyper-connected, digital revolution*, 8 May 2014, p.6.
[46] Selena Larson, Inside Amsterdam's efforts to become a smart city, *The Kernel*, 4 January 2015, at http://kernelmag.dailydot.com/issue-sections/features-issue-sections/11313/amsterdam-smart-city/
[47] ITU-T Focus Group on Smart Sustainable Cities, Multi-service infrastructure for smart sustainable cities in new-development areas, FG-SSC, May 2015.
[48] Want, Schilit, and Jenson, note 39, p.32.
[49] Mitchell, Villa, Stewart-Weeks and Lange, note 26, p.12.
[50] Tarkoma, note 10.
[51] GMSA, note 9, pp.3-9.
[52] Tarkoma, note 50
[53] OECD, Machine-to-Machine Communications: Connecting Billions of Devices, *OECD Digital Economy Papers*, No. 192, OECD Publishing, 2012, pp.26-27, at http://dx.doi.org/10.1787/5k9gsh2gp043-en
[54] Tarkoma, note 50.
[55] Tarkoma, note 50.
[56] Eric Openshaw, Craig Wigginton, John Hagel, John Seely Brown, Maggie Wooll and Preeta Banarjee, *The Internet of Things Ecosystem: Unlocking the Business Value of Connected Devices*, Deloitte, 2014, p.11, at http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-Iotecosystem.pdf

[57] Openshaw, Wigginton, Hagel, Seely Brown, Wooll and Banarjee, note 56, p.10.
[58] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, p.48.
[59] Republic of Korea, note 45, p.4.
[60] Mailyn Fidler, *Ubiquity, Interrupted? A Comparison of European, Chinese, and U.S. Governance of the Internet of Things as an Emerging Technology*, First Annual Conference on Governance of Emerging Technologies, Phoenix, AZ, 2013.
[61] G. Tassey, Standardization in technology-based markets. *Research Policy* 29(4)-29(5), 2000, pp.587-602.
[62] Internet of Things Global Standards Initiative, at http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx
[63] FCC TAC IoT Working Group, note 79.
[64] T. Wachtel. *10th Meeting of the Internet of Things Expert Group*. Brussels, 14 November 2012.
[65] oneM2M, *oneM2M Security Solutions*, Technical Specification, 1 August 2014, at http://www.onem2m.org/images/files/deliverables/TS-0003-Security_Solutions-V-2014-08.pdf
[66] Industrial Internet Consortium, *About Us*, at http://www.iiconsortium.org/about-us.htm
[67] AllSeen Alliance, *An Open Source project building the framework for the Internet of Things (IoT)*, May 2015, at https://allseenalliance.org/sites/default/files/resources/intro_to_alliance_5.21.15.pdf
[68] Vermesan and Friess, note 42, pp.151-152.
[69] Want, Schilit, and Jenson, note 39, p.33.
[70] Want, Schilit, and Jenson, note 39, pp.33-34.
[71] http://www.amsterdamopendata.nl/home
[72] http://www.citysdk.eu/about-the-project/
[73] Larson, note 46.
[74] Larson, note 46.
[75] European Commission, *Conclusions of the Internet of Things public consultation*, 28 February 2013.
[76] FTC Staff Report, note 33, pp.vii-viii.
[77] ITU-T Recommendation Y.2060, note 6, s.8.4.
[78] Dan Worth, Microsoft and BT to begin white space spectrum trials, *V3*, 2 October 2013, at http://www.v3.co.uk/v3-uk/news/2298124/microsoft-and-bt-to-begin-white-space-spectrum-trials
[79] US Federal Communications Commission Technological Advisory Council Internet of Things Working Group, Spectrum: Initial Findings, *FCC TAC meeting update*, 10 June 2014, at http://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting61014/TACmeetingslides6-10-14.pdf
[80] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, p.24.
[81] Republic of Korea Ministries of Science, ICT and Future Planning, note 59, p.11.
[82] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, p.24.
[83] Paul Barbagallo, As 'Internet of Things' Evolves, FCC's Spectrum Strategy Will Be Put to the Test, Bloomberg BNA, 19 November 2014, at http://www.bna.com/internet-things-evolves-n17179912070/
[84] http://www.sigfox.com/en/#!/technology
[85] Republic of Korea Ministries of Science, ICT and Future Planning, note 59, p.4.
[86] OECD, note 53, p.20.
[87] The endangered SIM card, *The Economist*, 20 November 2014, at http://www.economist.com/news/business/21633870-moves-reinvent-or-even-abolish-sim-card-could-have-big-consequences-endangered-sim?frsc=dg%7Ca&fsrc=scn/tw_app_ipad
[88] GSMA, *How China is set for global M2M Leadership*, June 2014, at http://www.gsma.com/newsroom/wp-content/uploads/2014/06/china-report.pdf
[89] OECD, note 53, pp.30-31.
[90] Bundesnetzagentur, *Marktbefragung zu einem zukünftigen Nummernplan für Internationale Kennungen für Mobile Teilnehmer (International Mobile Subscriber Identity, IMSI)*, Mitteilung Nr. 819/2014, Amtsblatt Nr. 15/2014, at http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehm

en_Institutionen/Nummerierung/Technische%20Nummern/IMSI/Mitteilung819_2014.pdf?__blob=publicationFile&v=2

[91] The Economist, note 87.

[92] Belgisch Instituut Voor Postdiensten En Telecommunicatie, *Raadpleging Op Vraag Van De Raad Van Het Bipt Van 25 November 2014 Met Betrekking Tot De Herziening Van Het Beleid Inzake Het Beheer Van Het Nummerplan*, at http://www.bipt.be/public/files/nl/21394/Consult_review_KB_Nummering_NL.pdf

[93] CEPT ECC, Evolution in the Use of E.212 Mobile Network Codes, ECC Report 212, 9 April 2014, at http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP212.PDF

[94] Want, Schilit, and Jenson, note 39, p.30.

[95] Helen Rebecca Schindler, Jonathan Cave, Neil Robinson, Veronika Horvath, Petal Jean Hackett, Salil Gunashekar, Maarten Botterman, Simon Forge and Hans Graux, *Europe's policy options for a dynamic and trustworthy development of the Internet of Things*, RAND Corporation, 2013, pp.50-52, at http://www.rand.org/content/dam/rand/pubs/research_reports/RR300/RR356/RAND_RR356.pdf

[96] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, p.23.

[97] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, pp.23-25.

[98] Article 29 Working Party, note 117, p.19.

[99] Republic of Korea Ministries of Science, ICT and Future Planning, note 59, p.11.

[100] Schindler, Cave, Robinson, Horvath, Hackett, Gunashekar, Botterman, Forge and Graux, note 95, p.86.

[101] European Commission, note 75.

[102] Center for Democracy and Technology, *Comments to the Federal Trade Commission after November 2013 Workshop on the "Internet of Things"*, 10 January 2014, p.3, at https://cdt.org/files/pdfs/iot-comments-cdt-2014.pdf

[103] FTC Staff Report, note 33, p.12.

[104] Paul Thomas, *Despite the News, Your Refrigerator is Not Yet Sending Spam*, Symantec Official blog, 23 January 2014, at http://www.symantec.com/connect/blogs/despite-news-your-refrigerator-not-yet-sending-spam#!

[105] Kevin C. Tofel, Got an IP webcam? Here are 73,000 reasons to change from the default password, *GigaOm Research*, 7 November 2014, at https://gigaom.com/2014/11/07/got-an-ip-webcam-here-are-73000-reasons-to-change-from-the-default-password/

[106] FTC Staff Report, note 33, p.13.

[107] Ashkan Soltani, What's the security shelf-life of IoT? *Tech@FTC blog*, 10 February 2015, at https://www.ftc.gov/news-events/blogs/techftc/2015/02/whats-security-shelf-life-iot

[108] Cesar Cerrudo, *An Emerging US (and World) Threat: Cities Wide Open to Cyber Attacks*, IOActive Labs White Paper, 2015, at http://www.ioactive.com/pdfs/IOActive_HackingCitiesPaper_CesarCerrudo.pdf

[109] See for example the US Federal Trade Commission's orders Credit Karma, Inc., File No. 132-3091 (Mar. 28, 2014); Fandango, LLC, File No. 132-3089 (Mar. 28, 2014) (consent); and HTC America, Inc., No. C-4406 (July 2, 2013) (consent), discussed in FTC staff report, note 115.

[110] Article 29 Working Party, note 120, p.18.

[111] 36th International Conference of Data Protection and Privacy Commissioners, *Mauritius Declaration on the Internet of Things*, 14 October 2014, p.2, at http://www.privacyconference2014.org/media/16596/Mauritius-Declaration.pdf

[112] 36th International Conference of Data Protection and Privacy Commissioners, note 111, p.2.

[113] See B.J. Koops and R. Levene, Privacy Regulation Cannot Be Hardcoded. A Critical Comment on the 'Privacy by Design' Provision in Data-Protection Law, *International Review of Law, Computers & Technology* 28 (2), 2014, pp.159-171; ENISA, *Privacy and Data Protection by Design*, December 2014.

[114] C. Cuijpers & B.J. Koops, Smart metering and privacy in Europe: Lessons from the Dutch case. In S. Gutwirth et al. (Eds.), *European data protection: Coming of age*, Springer, 2012, pp.269- 293.

[115] FTC Staff Report, note 33, p.28.

[116] Graham Greenleaf, Sheherezade and the 101 Data Privacy Laws: Origins, Significance and Global Trajectories, *Journal of Law, Information & Science* (2014) 23(1).

[117] Article 29 Data Protection Working Party, *Opinion 8/2014 on the on Recent Developments on the Internet of Things*, 16 September 2014.
[118] Article 29 Working Party. *Opinion 9/2011 on the revised Industry Proposal for a Privacy and Data Protection Impact Assessment Framework for RFID Applications*. 11 February 2011.
[119] Article 29 Working Party, note 120, p.6.
[120] Article 29 Data Protection Working Party, *Opinion 8/2014 on the on Recent Developments on the Internet of Things*, 16 September 2014, p.8.
[121] FTC Staff Report, note 33, p.17.
[122] Scott R. Peppet, Regulating the Internet of Things: First Steps Towards Managing Discrimination, Privacy, Security and Consent, 93 *Texas L. Rev.* 85 (2014), pp.115-16.
[123] Peppet, note 122, p.93.
[124] Article 29 Working Party, note 117, p.8.
[125] Article 29 Working Party, note 120, p.17.
[126] Article 29 Working Party, note 120, p.20.
[127] FTC Staff Report, note 33, pp.39—42.
[128] Article 29 Working Party, note 120, p.16.
[129] Jack H. Park, Government to Ease Up on Regulations on Financial Technology, Internet of Things, *BusinessKorea*, 12 December 2014, at http://www.businesskorea.co.kr/article/7814/internet-deregulations-government-ease-regulations-financial-technology-internet-things

GSR discussion paper

Interoperability in the digital ecosystem

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 25 June 2015.

The views expressed in this paper are those of the author and do not necessarily reflect the opinions of ITU or its Membership.

Table of Contents

Page

Executive summary ..... **v**

1 Introduction **1**

2 Interop framework and use cases **2**

2.1 Mobile payments: Interop layers applied 4

3 Benefits of higher levels of interop **9**

3.1 Innovation 9

3.2 Competition 10

3.3 Autonomy, flexibility, and choice 11

3.4 Access, diversity, and openness 11

4 Potential risks and drawbacks **12**

4.1 Increased security risks 12

4.2 Decreased privacy 12

4.3 Increased homogeneity 13

4.4 Decreased reliability 13

4.5 Decreased accountability 14

4.6 Decreased accessibility 14

4.7 Threats to business models 14

5 Approaches **16**

5.1 Non-regulatory approaches (private actors) 16

5.1.1 Unilateral design and IP licensing 16

5.1.2 Technical collaboration 17

5.1.3 Standards and open standards 17

5.2 Regulatory approaches (state actors) 18

5.2.1 Mandating standards 18

5.2.2 Disclosure of interoperability information (compulsory licensing) 19

5.2.3 Transparency rules (labeling requirements) 20

5.2.4 Market power in procurement decisions 20

5.2.5 Competition law 21

5.2.6 Supplementing strategies 21

5.3 Benchmarks for Interop 21

5.3.1 Effectiveness 21

5.3.2 Efficiency 22

5.3.3 Flexibility 22

6 Role of governments and regulators 22

6.1 Role of governments *qua* governments 22

6.2 Role of governments as legal stewards 23

7 Important issues for the future 25

Appendix 1: Suggested additional readings 27

©ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Interoperability in the digital ecosystem

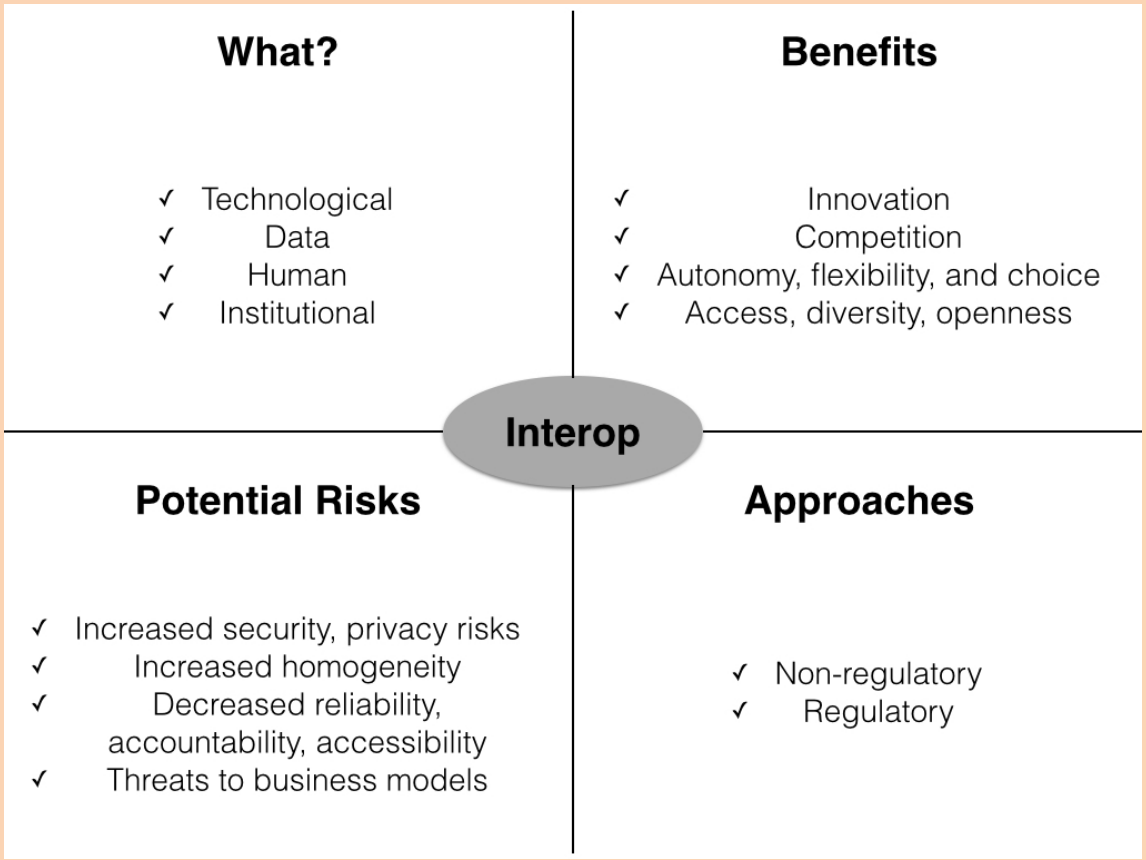
Author: Urs Gasser, Professor of Practice, Harvard Law School; Executive Director, Berkman Center for Internet & Society at Harvard University

Executive summary

At its most fundamental level in the context of the digital ecosystem, interoperability (or "interop") is the ability to transfer and render useful data and other information across systems, applications, or components. As a concept interop is central, and yet often invisible, to many parts of a highly interconnected modern society. The fact that someone can make a seamless international telephone call without thinking about things like "signaling standards" or transoceanic cables is a tribute to interop. So is the fact that someone can send and receive the same e-mail on a phone or in a browser, regardless of device manufacturer or ISP. And the development of the Internet of Things relies on interop. For that reason it is critical to develop a shared understanding how interop functions, the potential costs and benefits of increased levels of interop, and the variety of approaches for encouraging interop.

This paper begins by offering a framework for understanding interop as a concept. Figure 0 provides an overview of the concept of interop, its benefits, potential risks and approaches.

Figure 0 – Overview Diagram of interop:



Source: ITU

In theoretical terms, interoperability functions across four broad layers of complex systems: technological, data, human, institutional. For many people, it is the exchange of data through technological means that comes to mind when they think about interop. But it turns out that the human and institutional aspects of interoperability are often just as – and sometimes even more – important than the technological aspects.

This paper next offers examples of some of the many benefits and drawbacks of higher levels of interop. On the benefits side this includes: innovation, competition, choice and access. While, the potential drawbacks include: security and privacy risks, an increase in homogeneity, a decrease in reliability, accountability, accessibility, and a threat to certain existing business models.

The paper then offers a taxonomy for considering the various approaches that exist within the toolbox for managing and optimizing the level of interop. These approaches can either be deployed in a more unilateral fashion or they can be deployed in more collaborative ways. Moreover, there are approaches that can be deployed by the private sector and those that are utilized by regulators and other state actors. The paper also considers in more depth the unique role that governments and regulators can play in shaping the interop landscape.

Finally, the paper concludes by identifying some of the biggest questions and challenges that confront future interoperable technologies.

1 Introduction

Large segments of the world are now interconnected as never before: people stay in touch with far-away family and friends for low cost; they learn about news instantaneously, access knowledge remotely, collaborate more efficiently, and conduct every manner of business online. The most complex systems—government agencies, financial institutions, transportation infrastructures, health care and energy systems—are linked by these new, invisible information channels, which are essential components of today's global economy. But as interconnected as things currently are, they will grow dramatically more so thanks to the emergence of the "Internet of Things."

Generally speaking, the Internet of Things (or "IoT"), is the term for how anything that can be connected to the Internet will be. Interconnectedness through the Internet means not only new forms of interactions with end users, but also new forms of interactions with other devices. This is a world where the car of a driver who is running late will automatically send a text message to the driver's next appointment to let them know she's running late. Or where a jet engine can inform the ground crew that it needs maintenance before the plane even lands. Or where city parking meters can help drivers find open spots in order to reduce pollution and congestion. Or where a pill bottle can remind a patient to take their next dose. The possibilities for new forms of interconnectedness are staggering and endless.

Some experts believe that the market for IoT devices will grow exponentially over the coming years, resulting in over USD 1.7 trillion in value added to the global economy by 2019.[1] This explosion of new devices will require new infrastructure and technologies, with some analysts expecting that new infrastructure models will be deployed within two years and many existing networks will become overwhelmed with IoT traffic within just three years.[2]

This explosion of new IoT technologies, however, is built primarily on a single concept: interoperability. In order for a car, a jet engine, a parking meter, or a pill bottle to send and receive important data, it needs to be able to seamlessly connect to other systems and networks in ways that are meaningful and secure. That necessary interconnection of systems is interoperability (or "interop").

This capacity for connection has the ability to make daily life more convenient or efficient. But this growing level of interconnectedness comes at a potentially high price if designed or implemented poorly. Society must make trade-offs as it becomes digitally connected everywhere and anytime. Individuals struggle to keep up with news and information and also become more vulnerable, in ways that are less obvious and poorly understood. The same infrastructure that enables people to create, store, and share information can put their privacy and security at risk. Society's most advanced systems and infrastructures have become so complex that they are hard to manage effectively. And while many parts of daily life become more connected, some remain woefully underconnected.

For that reason, it is important to define the optimal level of interconnectedness and to understand how technology, markets, law, and regulation can shape the outcomes. As a first step, this paper looks at a framework for assessing how complex systems, components, and applications are connected—or sometimes, inexplicably, still separated. And then the paper evaluates some of the promises and the drawbacks that come with increased connectivity. Finally, the paper looks at approaches to enabling interop, and the role that governments, regulators, and organizations such as the ITU can play in that process.

---

[1] John Greenough, *The 'Internet of Things' will be the world's most massive device market and save companies billions of dollars*, Business Insider (Feb. 18, 2015), http://www.businessinsider.com/the-internet-of-things-market-growth-and-trends-2015-2#ixzz3WBO0CLrW.

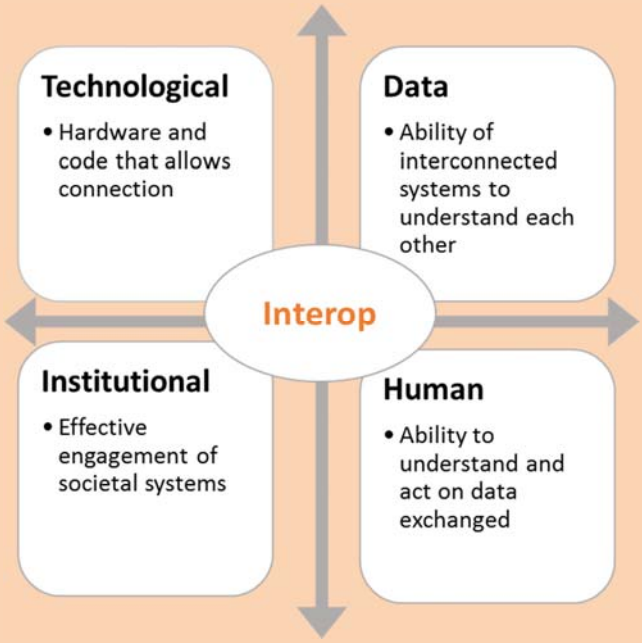
[2] IDC, *Press Release: IDC Reveals Worldwide Internet of Things Predictions for 2015*, Dec. 3, 2014, http://www.idc.com/getdoc.jsp?containerId=prUS25291514.

2 Interop framework and use cases

Defining interoperability is challenging because there is no one-size-fits-all definition. How one defines interop is based largely on context and perspective. For example, in the context of electronic health records, a patient may define interoperability as seamless access to his medical records. But the third-party operator of the hospital's e-health records database system may define interoperability as the ability to technically interconnect with the hospital's computer systems and integrate health records in a meaningful (and secure) way. In that regard, interop is not just one type of transaction or relationship; interop encompasses many forms of interaction, which often occur simultaneously. A transaction as simple as sharing electronic vaccination records with a new doctor might require numerous and concurrent forms of interoperability in order to succeed.

Although interop can mean many things, at its most fundamental level in the context of information technologies, it is the ability to transfer and render useful data and other information across systems, applications, or components. But this definition does not fully embrace the complex and varying layers of interop. In theoretical terms, interoperability functions across four broad layers of complex systems, as shown in Figure 1:

Figure 1 – Diagram of interop layers:



Source: ITU

For many people, it is the exchange of data through technological means that comes to mind when they think about interop. But case studies demonstrate that the human and institutional aspects of interoperability are often just as – and sometimes even more – important than the technological aspects.[3] How individuals work together as humans, often relying upon technological tools, can determine whether

[3] Berkman Center for Internet & Society, *Interoperability Case Studies*, https://cyber.law.harvard.edu/node/92249.

the most seamlessly interoperable technologies prove effective for their given task. For example recent research on online learning tools has shown that the students who have both human and online instruction get the most out of the experience.[4] The human instructors help to bridge the gap for the students where the software falls short of meeting their individual needs. In other words, it is not sufficient to simply connect students with knowledge without thinking about the other layers that affect their comprehension and how the students ultimately relate to the material.

What then do each of these interop layers mean?

- *Technological:* The technological layer is the hardware and code that allow one system to physically connect to another. Much like train tracks and roads allow cities to connect and share commerce, the technological layer allows systems to connect to one another and share data, often through an explicit, agreed-upon interface.
- *Data:* Without the ability to understand and process what is being transmitted, it is insufficient for technological systems to have the capacity to pass bits from one system to another. The data layer is the ability of interconnected systems to understand each other. Technological interoperability is often worthless without the data layer and the ability of interconnected systems to make use of the transmitted bits. The data and technological layers are often considered together because they are inextricably linked in many ways. However, anyone who has ever received an e-mail attachment that their computer could not open understands that simply having the technological capacity to receive data is not the same as interoperability at the data layer.
- *Human:* This layer is the ability for humans to understand and act on the data that is exchanged. Although it is more abstract than the technological and data layers, it can be just as crucial for interoperability. Language is one form of human interoperability—in order to communicate, people need to use a common language. Another form of human interop is a willingness to work together. Interop often succeeds or fails based on the individuals and personalities at the end points of the data exchange, and the level of effort and the good will they are willing to expend in order to work together successfully.
- *Institutional:* The institutional layer is the ability of societal systems to engage effectively. The legal system is one example of an institutional layer of interoperability. For instance, in order for two companies in different countries to collaborate, they need to reach a shared understanding of applicable law, and be comfortable that their rights can be vindicated. Interop at the institutional layer does not require homogeneity of legal systems; it instead requires only *enough* commonality to protect the interest of both parties.

Although they are related concepts, it is important to clarify the relationship between interoperability and compatibility. Compatibility is a specific form of interoperability that represents certain design choices in the development of a system. For example, in 2014, the EU approved a directive that called for the use of a common standard for cellphone chargers.[5] This legislation addressed a narrow design choice: the compatibility of the cables that provide power to mobile devices. The interoperability of mobile devices is a far bigger and more complicated issue than a single element of compatibility, but one element of the overall interoperability is the compatibility of cables. Throughout this paper, it is important to bear in mind that compatibility is an important part of interop and can play an important role in how well and easily systems work together.

---

[4] Justin Reich, *The Role of Humans in Blended Learning*, May 26, 2014, http://www.edtechresearcher.com/2014/05/the_role_of_humans_in_blended_learning/.

[5] Directive 2014/53/EU of The European Parliament And of The Council, 2014 O.J. (L. 153/62), http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014L0053&from=EN.

2.1 Mobile payments: Interop layers applied

In any complex interoperable system, all of four layers will play a role. In some examples one layer may be more important than others, but successful interoperability relies upon interconnections at every layer. The recent growth of mobile payment platforms is a useful illustration of how the layers interact to ultimately shape the success of the platform as a whole. In particular, the example highlights the important role that the institutional and human layers have played.

Mobile payments are like traditional credit card transactions, but mobile payments use a mobile device (typically a smartphone) in lieu of a plastic card. As smartphones have become more common, a variety of wallet-less electronic payment systems have proliferated, with mixed results. Beginning in 2011, Starbucks made it possible for customers to pay for their drinks using Starbucks' mobile app. Today, over 16% of US transactions at Starbucks are made through their app, representing over 7 million payments per week.[6] Around the same time, Google announced Google Wallet, and although Google does not share detailed figures, there is evidence suggesting it has had limited use.[7]

The divergent results of Starbucks and Google have not discouraged other market entrants from around the world. Recently, a federation of US retailers, including discount department store Walmart, announced CurrentC, a mobile payment platform designed to reduce the influence of traditional credit card companies and banks on retail transactions.[8] In October 2014, The Republic of Korea's Line messaging platform announced plans for a mobile payment service called Line Pay.[9] In March 2015, South Korean electronics giant Samsung purchased LoopPay, a system that allows greater backwards compatibility with older credit card retail terminals.

One of the most significant new entrants is Apple Pay, which was announced in September 2014. Within three days of becoming available, Apple processed 1 million card activations,[10] the number of card-issuing banks has grown from six in September 2014 to 2,500 in March 2015, and the number of retailers accepting Apple Pay has tripled to nearly 700,000.[11]

What unites all of these mobile payment systems is their reliance on interoperability. The need for interoperability becomes apparent when you consider the variety of actors involved in a single transaction, as documented in Figure 2, below. Interconnecting all of these actors across a variety of merchants and devices, requires numerous forms of interop at each layer. Although interop is necessary and present in every mobile payment platform, this example highlights a point that will be addressed later in this paper: interop is not a binary value – it can occur to greater and lesser degrees. The mobile payment competitors have taken different approaches, each trying to find the optimum level of interop, and Apple's and Starbucks' relative success in the mobile payment space demonstrates the importance of not neglecting the human and institutional layers.

---

[6] Marcus Wohlsen, *Forget Apple Pay. The Master of Mobile Payments is Starbucks*, Wired, Nov. 3, 2014, http://www.wired.com/2014/11/forget-apple-pay-master-mobile-payments-starbucks/.

[7] Charles Arthur, *How Many Google Wallet Users Are There? Google won't say - but we can*, The Guardian, Sept. 25, 2014, http://www.theguardian.com/technology/2014/sep/25/google-wallet-apple-pay-nfc.

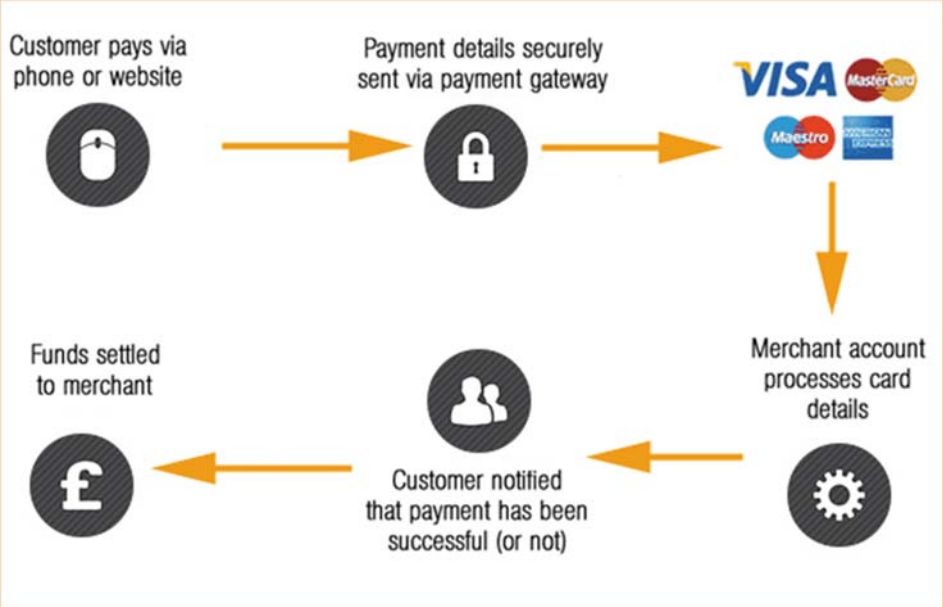
[8] Josh Constine, *CurrentC is the Big Retailers' Clunky Attempt to Kill Apple Pay and Credit Card Fees*, Tech Crunch, Oct. 25, 2014, http://techcrunch.com/2014/10/25/currentc/.

[9] Catherin Shu, *Line Pay, the Messaging App's Mobile Payments Service Will Make Its Global Debut Soon*, Tech Crunch, Dec. 4, 2014, http://techcrunch.com/2014/12/04/line-pay-the-messaging-apps-mobile-payments-service-makes-its-debut/.

[10] Daisuke Wakabayashi, *Apple CEO Tim Cook Happy With New Apple Pay Service*, WSJ, Oct. 28, 2014, http://www.wsj.com/articles/apple-ceo-tim-cook-happy-with-new-apple-pay-service-1414474181

[11] Anthony Ha, *Apple Pay Now Accepted In Nearly 700k Locations*, Tech Crunch, Mar. 9, 2015, http://techcrunch.com/2015/03/09/apple-pay-stats/#rU8Np5:AqOz

Figure 2 – Diagram of mobile payment processing and various actors:



Source: Web-Merchant.com, New to Online payments? http://www.web-merchant.co.uk/onlinepayments.asp

Consider some of the approaches the various payment platforms have taken to each layer:

Technologic: Successful implementation of a mobile payment system requires multiple kinds of technologic interoperability. One type of technologic interop is interconnections between banks and devices. For example, in order to initially set up a credit card to work with Apple Pay, Apple must have backend compatibility with the processing banks, in order to transmit securely to the banks user and card information.

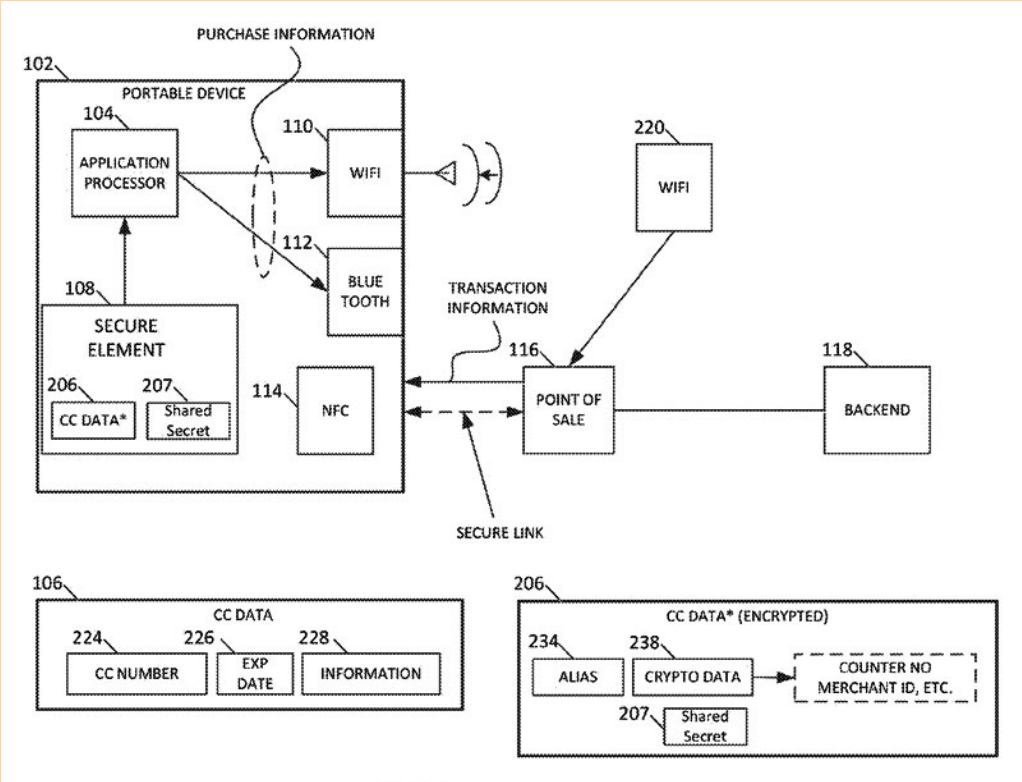
Another type of technologic interop is the ability of a mobile device to interconnect to the payment platform. Google Wallet, for instance, can run on a wide range of Android devices that contain a Near Field Communication (NFC) chip, which is necessary for communication with the retailer payment terminal.[12] Apple Pay also requires an NFC chip for exchanging data with payment terminals, however, Apple Pay also requires that the device is an Apple iPhone, and that the iPhone includes several security features including a special encrypted chip and Touch ID for biometric identification. Because only the newest iPhone 6 and iPhone 6 Plus have all of these technical components, those are the only devices that currently support Apple Pay, limiting Apple Pay's technologic interop across devices.

Another type of technologic interop is the ability of the device to interact with retailers' payment systems. Because Apple Pay and Google Wallet use NFC communication, only retailers that have NFC-capable payment terminals can accept those services. Only a small (but growing) number of payment terminals accept NFC, making this is a fairly significant limit on technical interop. Figure 3 is a drawing from an Apple patent that shows the way in which it interconnects with a retailer "point of sale." Although the patent does not necessarily describe the current iteration of Apple Pay, it highlights the complexity of the technological interop on the platform. CurrentC and Starbucks use bar codes instead of NFC, but this requires that the retailer payment system have an optical scanning device to read the bar code. Samsung's

[12] For more information on NFC, please see Daniel Howley, *What is NFC, and Why Does It Matter For The iPhone 6?*, Yahoo! Tech, Sept. 3, 2014, https://www.yahoo.com/tech/what-is-nfc-and-why-does-it-matter-for-the-iphone-6-96456683964.html.

Loop Pay is designed to work with both NFC and existing magnetic card swipe terminals, dramatically increasing the technical interoperability.

Figure 3: Apple patent diagram showing various components of Apple Pay system



Source: NFC World, http://www.nfcworld.com/2014/01/16/327536/apple-patent-combines-nfc-bluetooth-wifi-mobile-payments/

Data: For a retailer, simply having an optical reader or an NFC payment terminal is not sufficient for processing payments through CurrentC or Apple Pay, because in addition to technologic interop, retailers need interop at the data layer in order to work with any given mobile payment system. For example, at the technical layer, Apple Pay and Google Wallet could work with any retailer payment reader that uses NFC. However, not all NFC readers can process Apple Pay or Google Wallet data. In fact, retailers associated with the CurrentC standard, including some of the largest retailers in the United States, disabled the use of their NFC terminals in order to stymie NFC-based competitors.[13]

Similarly, in order for a bank to interoperate with a mobile payment platform, it needs more than technical connections to the device. For example, in order to increase the security of the transactions, Apple Pay creates one-time-use secure tokens that are transmitted to the bank instead of credit card numbers. The use of these tokens ensures that if a retailer is hacked, any captured numbers are unusable for future transactions.[14] However, using these one-time tokens requires that the issuing banks be able to interpret these tokens and match them back to a specific user account.

[13] Jason Del Rey, *Why You Can't Use Apple Pay at CVS, Walmart and Other Retail Stores*, Re/Code, Oct. 28, 2014, http://recode.net/2014/10/28/why-you-cant-use-apple-pay-at-cvs-walmart-and-other-retail-stores/.

[14] Bob Sullivan, *How Tokenization May Change The Way You Pay*, CNBC, Dec. 14, 2014, http://www.cnbc.com/id/102264704.

Human: One of the biggest reasons why Apple Pay and Starbucks have been successful with mobile payments has been their respective approach to the human layer. While other mobile payment systems are fairly complicated for the end users, setting up and using Apple Pay and the Starbucks app were engineered to be simple. For example, setting up a card in Apple Pay requires only that the user photograph an image of their card. And to use Apple Pay, the user simply holds the device near an NFC terminal and activates the biometric fingerprint reader for verification. By contrast, as Figure 4 shows, setting up CurrentC requires multiple steps including entering a passcode, entering checking account data, and entering other identifying information.

Figure 4: Screen capture of instructions for adding payment information to CurrentC account

5. Adding a New Payment Account - Checking Account (ACH)

Want to pay with CurrentC using your checking account? Here's how:

- Open the CurrentC application
- Enter your 4-digit Passcode
- From the Home Screen select the **Accounts** button
- Make sure the **My Payment** tab at the top of the screen is selected
- Select the **Add** button
  - For iPhone and iTouch - The add button is a plus sign at the top right of the Accounts screen
  - For Android – Press your phone's menu button
- Click the **Add Payment** button
- Select **Checking Account** from the list of account types
- Enter your checking account information – *Note: This information is not stored in your phone.*
- Enter your personal information – *Note: Driver's license number and social security number are used to confirm your identity. This information is not stored in your phone.*
- Select the **Submit** button

Source: CincoTec, http://www.cincotec.com/blog/apple-pay-vs-currentc

Institutional: Many mobile payment systems operate over the existing institutional credit card network that comprises the global payment processing system. This system has already established the norms and rules that help ensure that retailers and banks are fairly compensated. One aspect of this system is the fee that retailers must pay to the credit card companies to cover the cost of the complex institutional network. These so-called "swipe fees" average to about 2 per cent of each transaction, which retailers dislike.[15] For that reason, the CurrentC mobile platform, which is run by major US retailers, is trying to circumvent the existing institutional structure. By withdrawing against end-user checking accounts instead of using credit cards, CurrentC aims to take advantage of a different institutional structure relating to bank withdrawals, and thereby avoid the fees associated with credit card processing.

As the example of mobile payment systems demonstrates, all layers of interop are important. It is for that reason that no short definition of interop fully captures its scale and complexity. The example also highlights how technology, market, and law can either support or inhibit interoperability in a multitude of ways.

From a technical perspective, the mobile payments example shows that there is no single technical architecture that is necessary for interoperability. Some market actors use NFC, others use optical bar codes, and still others use hybrid technologies. A company's choice of technological platform can have a

[15] National Retail Federation, *Swipe Fees*, https://nrf.com/advocacy/policy-agenda/swipe-fees.

big impact on its ultimate interoperability; the more widespread and available the technology is, the greater the opportunities for interoperability.

From a market perspective, the mobile payments example shows the influence of network effects on actor behavior. The basic incentive structure on markets with network effects does not necessarily or automatically lead towards higher levels of interoperability among organizations, systems, or components. Instead, companies set interop strategy depending on firm-specific factors such as current market position, technological capabilities, and IP portfolio, among others. Apple, for example, seeks to use its mobile payment platform as a competitive differentiator. Thus, it has chosen not to interoperate with other mobile devices, limiting the platform to its newest iPhones.

And from a legal perspective the mobile payments shows the influence of general laws such as competition law, consumer protection law, contract law, or tort law, as well as self-regulatory enforcement. In particular, the self-regulation of the payment industry shows a bi-directional influence that simultaneously supports greater levels of interoperability and less. In the United States, new rules set by the industry will hold retailers liable for fraud unless they switch to new interoperable payment terminals by October 2015.[16] This self-regulation is increasing interoperability in several ways. First, the new payment terminals will support NFC payments, dramatically increasing interoperability between retailers and services like Apple Pay and Google Wallet. Second, it increases institutional interop by bringing the US into line with European standards for more secure credit card processing. However, the industry self-regulation (and specifically the fees associated with them) has arguably also decreased interoperability in some ways, as those fees pushed CurrentC to adopt its less interoperable approach to payment processing.[17]

The mobile payments example also highlights how interop is not a binary concept. There are degrees and types of interop, which fall along a multidimensional spectrum, explored in greater detail in Part 5 of this paper. Although all of the mobile payment systems involve various levels of interop, some take a more unilateral approach, while others rely upon collaboration. Because Google does not build smartphone hardware, they rely on cooperation from partners in order to deploy Google Wallet on compatible handsets. By contrast, because Apple controls its device ecosystem, creating and selling both the software and the hardware, it can deploy Apple Pay with less reliance on others.

The same diversity in kinds of interop can be observed in the approaches of regulators. As part of the US Government's Cloud Computing Strategy, for instance, the state and its regulators variously and simultaneously mandate interop standards, influence interop through procurement strategies, and help support the development of multistakeholder processes to develop additional standards and approaches.

The benefits and costs of interoperability are most apparent when technologies work together so that the data they exchange prove useful at the other end of the transaction. Consumers respond favorably to highly interoperable systems at the technology layer. Consumers consistently prefer systems that work together without asking them to and that make their lives simpler in the process. The data layer, a close cousin of the technology layer, turns out to be just as important: it is critical for data to be interoperable across systems as well. It is not enough merely to pass zeros and ones from one system to another. The data must in fact be readable and understandable. Without interoperability at the technology and data layers, interoperability at the higher layers in the model—the human and institutional layers—is often impossible. But the challenge of getting the basics of interoperability right, even at the fundamental technology and data layers, can be deceptively hard.

---

[16] Tom Gara, *October 2015: The End of the Swipe-and-Sign Credit Card*, Wall Street Journal, Feb. 6, 2014, http://blogs.wsj.com/corporate-intelligence/2014/02/06/october-2015-the-end-of-the-swipe-and-sign-credit-card/.

[17] Tony Bradley, *Blocking Apple Pay is a Terrible Strategy For CurrentC Merchants*, Forbes, Oct. 29, 2014, http://www.forbes.com/sites/tonybradley/2014/10/29/blocking-apple-pay-is-a-terrible-strategy-for-currentc-merchants/.

3 Benefits of higher levels of interop

Interoperability is not an end in itself. Instead, optimizing the level of interop has societal value as a means to others ends. Innovation is one policy goal that often benefits from increased interop, but it is not the only one. For example, interop can also have a positive impact on consumer choice, ease of use, access to content, and diversity, among other things. Below the paper highlights some of the key ways that higher levels of interop might be beneficial.

3.1 Innovation

Perhaps the strongest example of how interop can foster innovation is *the Internet* itself. The Internet has the ultimate interoperable design in which more and more non-interoperable networks and systems have converged. It is on this open, interoperable infrastructure that the Internet of Things (IoT) is being built. Every IoT device from a jet engine requesting service with a ground crew to a thermostat checking the weather relies on the fact that the protocols that enable devices to connect across the network are agnostic to the data that is transmitted using those protocols. In other words, high degrees of interoperability enable and foster innovation over the Internet, including deploying networked devices.

Companies with a strong interest in the IoT are currently hoping to replicate the success of the Internet by spurring innovation at the IoT layer, which itself runs on top of the Internet. For example, one consortium of tech companies has created Thread, an open protocol to help connect low-power devices. And yet another consortium of tech companies is creating a protocol to enable faster and easier device discovery and interconnection.[18] Outside of the commercial context, the ITU has also been a leader in advancing standardization in the IoT space.[19] In all cases, the hope is that building protocols to enable interconnections will support increased innovation on top of an IoT platform.

It is worth bearing in mind that although innovation is generally positive, it can include some risks. Innovation can be bi-directional. Just as interop can help support the development of innovative devices and software that has positive social value, it can also support innovative devices and software with negative social value. On the Internet, worms, viruses, spam, and other unwanted activity are in many ways just as "innovative" and just as dependent on interoperability as more positive developments. A recent example of this peril was in the Heartbleed vulnerability in the SSL protocol that enables secure, encrypted communication across the Internet.[20] Because the SSL protocol is interoperable, anyone with enough technical knowledge can write a version of the protocol that can be used interchangeably with other implementations. One version, called OpenSSL, became so popular that it was running on an estimated 66% of the Internet. Unfortunately, OpenSSL had a critical flaw—Heartbleed—that allowed attackers to potentially see encrypted communications. Thus, interop enabled this vulnerability to become widespread.

Additionally, high degrees of interop can sometimes threaten innovation. For instance, a successfully interoperable system—by unleashing network effects – can lead to very high switching costs for consumers, thereby potentially diminishing developers' incentives to invest in an entirely new technology, i.e., a *radical* innovation that would seek to replace the old one. Under such a scenario, innovators might only focus on incremental change of existing interoperable systems and foreclose opportunities for radical innovations–even if the alternative system would be superior.

---

[18] Tina Amirtha, *Google's Secret Weapon in the Battle for the Internet of Things: Academia*, Fast Company, Feb. 10, 2015, http://www.fastcompany.com/3041698/googles-secret-weapon-in-the-battle-for-the-internet-of-things-academia.

[19] ITU, Internet of Things Global Standards Initiative, http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx.

[20] The Heartbleed Bug, http://heartbleed.com.

3.2 Competition

Standard economic analysis suggests that increased interoperability is likely to foster innovation by reducing lock-in effects and lowering barriers to entry. This pattern is observable in the subscription streaming video market. HBO, a movie network and content creator, recently began selling its "HBO Now" service directly to consumers over the Internet, breaking with its traditional business model of selling only through cable and satellite providers.[21] Under its old model, HBO's content distribution system needed to interoperate only with the systems for cable and satellite providers. Under the new model, however, HBO enabled interoperability with web browsers and devices such as Apple TV, Roku, Chromecast, and others. This change toward increased interoperability has increased competition in two ways. First, it has increased competition for subscription TV services. By decoupling HBO content from subscription TV, cable and satellite operators can no longer rely on content monopolies to ensure customer lock-in. In fact, several cable companies have begun offering "skinny" packages consisting of high-speed broadband, HBO, and few other channels, in order to compete with online-only content like HBO Now and Netflix.[22] Second, by increasing its interoperability, HBO is competing with an entirely different market: online movie streaming services. This shift has not gone unnoticed by Reed Hastings, CEO of Netflix, who recently remarked "I predict HBO will do the best creative work of their lives in the next 10 years because they are on war footing. They haven't really had a challenge for a long time, and now they do. It's going to spur us both on to incredible work."[23] This kind of competition benefits users by reducing prices and by providing incentives for product and service innovation.

Although interop generally supports competition, in some circumstances it could, counter-intuitively, lead to anticompetitive situations. For instance, certain unilateral or bilateral arrangements by firms that lead to interoperability and to greater innovation may promote a single firm or a few firms in a manner that is, over time, anticompetitive. For example, standards consortiums may sometimes create closed standards that enable interoperability across only the products of their stakeholders.[24] In this way, interoperability can be deployed as a tool for building closed ecosystems. The value to the consumer of being in the ecosystem (and benefitting from the interoperability the ecosystem provides) can in turn raise switching costs and reduce competition.[25]

Even in the general case where more interoperability leads to competition in the market, this does not mean that the net effect is maximum innovation. According to one strand of economic theory, firms may have an even stronger incentive to be innovative in circumstances where low levels of interoperability would promise higher or even monopoly profits to successful competitors. This sort of (Schumpetrian) competition for the market sets incentives to come up with entirely new generations of technologies or ways of doing business (so-called "leapfrog competition") in order to replace incumbent players and achieve temporary dominance. Amazon's strategy in the e-book market might be seen as a case-in-point for this

---

[21] Miriam Gottfried, *HBO Now Spells Trouble for Pay TV's Tomorrow*, Wall Street Journal, Apr. 9, 2015, http://www.wsj.com/articles/hbo-now-spells-trouble-for-pay-tvs-tomorrow-heard-on-the-street-1428615881.

[22] *Id.*

[23] Emily Steel, *Netflix Is Betting Its Future on Exclusive Programming*, NY Times, Apr. 19, 2015, http://www.nytimes.com/2015/04/20/business/media/netflix-is-betting-its-future-on-exclusive-programming.html.

[24] Sam Paltridge, Michael Donohue, Brigitte Acoca, *2015 OECD Digital Economy Outlook: Chapter 5: Emerging Issues: The Internet of Things*, OECD, DSTA/ICCP(2014)15/CHAP5/REV1 (Mar. 20, 2015), at ¶ 38.

[25] Eric Jackson, *Apple Isn't a Hardware or Software Company – It's an Ecosystem Company*, Forbes, June 30, 2014, http://www.forbes.com/sites/ericjackson/2014/06/03/apple-isnt-a-hardware-or-software-company-its-an-ecosystem-company/ (describing how the value of being in Apple's ecosystem increases as their devices gain greater interoperability *within* Apple's own platform).

sort of competition. Initially, Amazon's e-books could not be used on most non-Kindle devices, and thus evidenced low levels of interoperability as the company searched for monopoly profits. Although Amazon e-books can now be read using Amazon's free reader software on Android, iOS, Windows, and OS X devices, it remains true that Amazon e-books can only be read on either Amazon devices or through Amazon's software.

3.3 Autonomy, flexibility, and choice

In almost all circumstances, increased levels of interoperability tend to enhance user choice and autonomy. In interoperable ecosystems, users are more likely to choose among competitive and efficient options with regard to systems, applications, components, etc., which may be tested, mixed, and matched for specific purposes. One way that interoperable systems offer choice is through application programming interfaces (APIs), which are instructions for how one application or system can talk to another.[26] Twitter had an open API, which allowed anyone to write a Twitter client that could access Twitter's underlying data. The Twitter API supported a vibrant Twitter client ecosystem and users could switch easily between the Twitter clients of their choice. Twitter's decision to change their API in order to capture all of the client traffic, and ultimately capture the ad revenue, has reduced user choice and nearly eliminated the availability of third-party clients.[27]

Users are not the only ones who may have greater freedom to make choices when the level of interoperability increases. Consider, for instance, publishers in the e-book business that may run the risk of being locked into a gatekeeper-like distribution channel. If Amazon builds up a dominant market position based on a non-interoperable system, publishers will have no choice but to sell to Amazon at nearly any price it demands. By contrast, an interoperable system would lower the barriers to entry, making it difficult for Amazon to lock publishers into bad deals. In fact, it was this fear that led to the recent high-profile dispute between Amazon and publishers.[28]

3.4 Access, diversity, and openness

Increased levels of interoperability can make it easier for users to access content. Creating an account can be a hurdle for users, and if they do create an account, users are likely to reuse a simple password they can remember. Single-sign on digital ID infrastructure seeks to address both of these concerns. First, single-sign on infrastructure allows users to log into new services using existing credentials, such as their Facebook account. This lowers the barrier to joining new services and speeds up the process. Second, because the user can log in without creating a new account, it means that user needs to remember only their single-sign on password, instead of creating a new password. "Login with Facebook" is one example of this approach, intended to make it easier for users to log into a variety of online services, not just Facebook.com. As more sites interoperate with a single-sign on platform, the value to the user increases, as it reduces access barriers to online services of various sorts, including e-commerce platforms.

Similarly, there appears to be positive relation between interoperability and "diversity." As noted above, Twitter's open API supported a variety of clients. Moreover, when that API was restricted, it quickly led to a decrease in diversity of Twitter clients, with several unable to sustain their business following Twitter's changes.

---

[26] Brian Proffitt, *What APIs Are and Why They're Important*, Read Write, Sep. 19, 2013, http://readwrite.com/2013/09/19/api-defined.

[27] Mike Beasley, *Twitterrific 5 for Mac may become the first casualty in Twitter's war on developers, but it won't be the last*, Nov. 25, 2014, http://9to5mac.com/2014/11/25/twitterrific-5-twitters-war-on-developers/.

[28] David Streitfeld, *Amazon and Hachette Resolve Dispute*, NY Times, Nov. 13, 2014, http://www.nytimes.com/2014/11/14/technology/amazon-hachette-ebook-dispute.html?_r=0.

4 Potential risks and drawbacks

Interoperability is not an unalloyed good. In certain instances, greater interoperability brings with it possible drawbacks. These problems tend to be highly fact-specific and are often not problems related to interoperability *per se*, but rather are related to what people do with the systems once they are made to interoperate.

4.1 Increased security risks

As described above, systems can increase interoperability by providing greater opportunities for technical interconnection, being more open about the types of systems and services that can interconnect, supporting a greater variety of data, making it easier for humans to leverage the interconnections, and more. Unfortunately, each of these forms of interop can also increase the opportunities to exploit the system. A system that has more points of access, allows more types of systems to connect, and processes data with fewer limitations, increases potential attack vectors and creates more opportunity for nefarious actors to exploit data or to inject bad code. For example, single sign-on systems like Facebook's "Login With Facebook" can provide great convenience for end users, but it can also mean that a single stolen credential gives an attacker carte blanche access to numerous online systems, instead of just Facebook itself.[29]

This security concern is not precisely a problem with interoperability, nor is it insurmountable. The fact that the systems can interoperate does not *per se* mean that more people have access to underlying data in a given system. It is theoretically possible that increased interoperability as between systems could lead to further vulnerability of the different components or systems if sound security measures are not taken. For example, it was recently discovered that the mobile payment system Apple Pay was being used for credit card fraud.[30] The problem, as it turned out, was not one of interoperability *per se*, but rather that banks were not properly verifying account credentials when users set up Apple Pay accounts. Criminals were able to take advantage of banks' lax verification protocols by registering stolen credit card numbers in Apple Pay. Interoperability may increase the number of opportunities for security breaches, or the potential fall out from such breaches, but it is not the cause of the security vulnerabilities themselves. By the same token, systems that are not interoperable at all are just as likely to have damaging security breaches if proper precautions are not taken.

4.2 Decreased privacy

The possibility, in certain situations, that interoperability might reduce individual privacy is among the most commonly voiced concerns about interoperability. It is true that increased levels of interoperability may increase the number of players who could plausibly have access to personal information exchanged via an interoperable system. Single sign-on systems are the most obvious setting in which interoperability might lead to less user privacy: if technical and user controls are not well-established, the fact that multiple service providers have access to a user's online identity increases the risk of one of them misusing that data. In the electronic health records context, where privacy is of the utmost importance, it has been argued that an interoperable standard may allow highly sensitive personal data to be captured or stolen. In both cases, the higher risk of technical failure is a consequence of the fact that interoperability encourages more complex ecosystems, with more participants, and thus creates more risk vectors. Against that backdrop, it becomes clear that it is not interoperability *per se* that gives rise to increased privacy risks, but rather the specificities of its implementation. Even if one assumes that a technically waterproof interoperable solution cannot be achieved—a highly debated assertion—one can

---

[29] Amit Chowdhry, *How Facebook Finds Out If Your Passwords Were Stolen*, Forbes, Oct. 22, 2014, http://www.forbes.com/sites/amitchowdhry/2014/10/22/how-facebook-finds-out-if-your-passwords-were-stolen/.

[30] Robin Sidel, *Apple Pay Sign-Ups Get Tougher as Banks Respond to Fraud*, Wall Street Journal, Mar. 6, 2015, http://blogs.wsj.com/totalreturn/2015/03/06/apple-pay-sign-ups-get-tougher-as-banks-respond-to-fraud/.

imagine organizational or legal tools, such as privacy regulation, successfully addressing the respective privacy concerns.

4.3 Increased homogeneity

Interoperability might lead to less diversity in a market. A single platform, with which many systems interact, might become a *de facto* standard in such a way as to constrain innovation to what is possible on or within that platform. As with possible concerns related to security and privacy, it is not interoperability *per se* that would lead to this homogeneity, but rather the conditions that might flow from the extent to which parties avail themselves of the interoperability.

Although the Internet is a wonderfully interoperable system that has led to tremendous innovation, the protocols that underlie it represent a form of homogeneity. Most of the interconnected systems that people use today rely on TCP/IP at some level to connect systems to each other, networks, or the Internet itself. The protocols themselves do not include security components or end-to-end data reliability, which requires things like encryption to be built on top of the protocol.[31] In that way, the prevalence of the Internet protocols constrains innovation; security and other necessary components must be built on top of the protocol, because it would be too hard to innovate new protocols and get widespread adoption, even if those new protocols were arguably better. In the same way, e-mail protocols have become a *de facto* standard, meaning that innovations in security for e-mail must be built upon an existing set of protocols. This homogeneity constrains what is possible, ultimately providing an upper bound on the security that can be achieved in standard e-mail.[32]

4.4 Decreased reliability

The increased complexity of interoperable systems may lead to decreased reliability. This possible drawback depends heavily on the approach taken towards interoperability. As more systems rely on interop to interconnect, the overall network grows in complexity, and flaws in these systems might be difficult to fix quickly or even identify. In some instances, flaws in one system, on which other systems have come to rely, may not be fixable at all by the relying party. This problem might affect consumers, too, who find that they cannot identify a single point of contact in order to get a problem fixed, but rather need to call upon more than one entity. Consider a customer at a store who is having trouble using their mobile payment system. Is the problem with the retailer's payment terminal? The customer's mobile device? The payment system they are using? The underlying credit card infrastructure? It may be challenging for the customer to properly diagnose the issue. In fact, nearly two thirds of Apple Pay users have reported problems using the service, which has led many to simply give up on the system, particularly if the problems are outside of the customer's control.[33] As systems that interoperate scale, the level of complexity will continue to rise.

Reliability also has variation, as well: reliance. As interoperability increases, downstream systems may become increasing reliant on upstream systems. This problem was observed when Twitter's decision to change its open API threatened the business of the downstream systems that were built on top of that API. Although there was no promise between downstream and upstream entities to maintain the status

---

[31] Ian Peter, *Can TCP/IP Survive?* Circle ID, Sep. 7, 2004, http://www.circleid.com/posts/can_tcp_ip_survive (Article describing several of the weaknesses in the TCP/IP protocol).

[32] David Talbot, *Why E-mail Can't Be Completely Private*, MIT Technology Review, Aug. 14, 2013, http://www.technologyreview.com/news/518056/why-e-mail-cant-be-completely-private/.

[33] Tim Higgins, Elizabeth Dexheimer, *Apple Pay Running Into Hurdles at Checkout Counter, Survey Finds*, Bloomberg Business, Mar. 31, 2015, http://www.bloomberg.com/news/articles/2015-03-31/apple-pay-running-into-hurdles-at-checkout-counter-survey-finds-i7x95shl.

quo, such examples threaten interoperability more generally by reducing the incentive of downstream entities to invest in interoperability.

Reliability is one area where an open standards approach to interoperability holds out significant promise to both the reliability and reliance challenges. In complex, interoperable systems, it would be most helpful if problems could be solved by firms and for consumers as seamlessly as possible, without always having to come back to a single firm to fix an underlying problem. Open standards could mitigate, though not outright solve, this issue, insofar as problems could be solved collaboratively, with multiple stakeholders represented in the process of solution identification and implementation.

4.5 Decreased accountability

Interoperability is often accompanied by an increase of complexity in the relations among private actors, especially in the context of industry-driven interoperability initiatives. Against this backdrop, the question of responsibilities and liabilities calls for increased scrutiny. In context of single sign-on for digital IDs, for example, one can imagine a scenario in which a user's identification is misused by a third party, such as an advertiser, with whom the user has no contractual relationship. The lack of a contractual relationship may hinder the user's ability to be properly compensated for the harm. However, the example reveals that these concerns, again, are less a consequence of interoperability *per se* than of a concrete implementation, and that one might assume that a careful drafting of contracts (in this example: between the user and the identity provider) should avoid unintended and unnecessary liability exposure. As an alternative, the digital identity provider could take a more active role in policing the third parties with which they do business. Facebook recently took this step, demanding that companies using Facebook credentials submit to "an audit process that requires them to explain why they've chosen to collect certain pieces of customer information in their data payload," and based on those explanations Facebook can choose to deny access to data.[34]

4.6 Decreased accessibility

Looking at the aforementioned risks of decreased reliability and security as a result of interoperability, concerns have been voiced that such developments could induce different players to withdraw from the online environment as such. In the electronic health care record industry, for instance, there were concerns that interoperability would pose higher security risks than non-interoperable solutions and would prompt either doctors or patients to opt-out of the system. Although that has not been observed to date, if it were to occur, accessibility would decrease and the efficiency and health gains of online distribution could not be realized.

4.7 Threats to business models

Similar to the other downsides of increased levels of interop, the threats that interop poses to existing business models is not a downside of interop *per se* but is instead a factor of both the concrete implementation of interop and the extent to which incumbents have relied upon lower levels of interop in the design of their business models. As described above, higher levels of interop can have many benefits, but those benefits may be unequally distributed across a market. Indeed, some businesses may have a vested interest in maintaining *lower* levels of interop where they benefit and rely upon models that are built upon the lock-in of customers. For example, as of 2012, Amazon's Kindle e-reader devices were sold

[34] Alexandra Larralde, *Social Login Trends Across the Web: Q4 2014*, Janrain, Jan. 8, 2015, http://janrain.com/blog/social-login-trends-across-the-web-q4-2014/.

at cost, with the company profiting solely from the fact that customers are locked into the Amazon ecosystem for purchasing content for their devices.[35] Amazon achieves this customer lock-in by limiting both technological and other forms of interop. At the technologic layer of interop, although Amazon enables the Kindle to interoperate in limited ways with the services of other firms, such as a daily download of the *New York Times* or reading e-books on a Kindle iPhone, iPad, or Android app, the company does not allow its e-books to be read through non-Amazon software or e-readers. Similarly, the Kindle does not support common open formats such as EPUB. This lack of technical interop helps ensure that customers will rely upon Amazon's marketplace for content.

Amazon has also tried to reduce interop at the data and human layers, by limiting publishers' alternatives to Amazon. As part of its business strategy, Amazon has priced e-books at lower prices than competitors (sometimes at a loss) in order to encourage lock-in. Several book publishers began to fear that this customer lock-in would kill competitors and enable Amazon to demand monopolist pricing from publishers. Some of these publishers recently challenged Amazon's strategy, asserting that they wanted to set prices equally across e-book stores—in other words, the publishers wanted to increase the interoperability of their content across platforms. This conflict between publishers and Amazon became a public dispute when Amazon pulled most Hachette books from its store in retaliation. After a protracted battle, the publishers won temporary control over the prices for their books.[36]

The fact that higher levels of interop may pose a threat to certain business models is not a downside of interop *per se*, nor is it a reason to avoid policies and stratagem that promise higher levels of interop. In some circumstances, disrupting these kinds of business models may itself be a benefit of higher levels of interop.[37] That said, it is important to acknowledge that higher levels of interop may not be viewed positively by all affected parties, and those whose business models are threatened by higher levels of interop may take fight actively against those policies.

Taken together, these risks and drawbacks to interop can paint a challenging picture. But the potential negative aspects of a highly interoperable future do not need to come to pass. To be certain, the risks are very real, and those risks are connected to the degree and type of interoperability that is established between and among technologies. That said, the risks are largely ones of implementation and not endemic to interop itself. For that reason, as individuals, business, and regulators build an increasingly interconnected world at the technology and data layers, care must be taken to ensure that the system does not come with costs in other areas—such as privacy and security—that are higher than society is willing to pay. A theory of interoperability by design that builds in privacy and security protections from the start can help enormously in this respect.

---

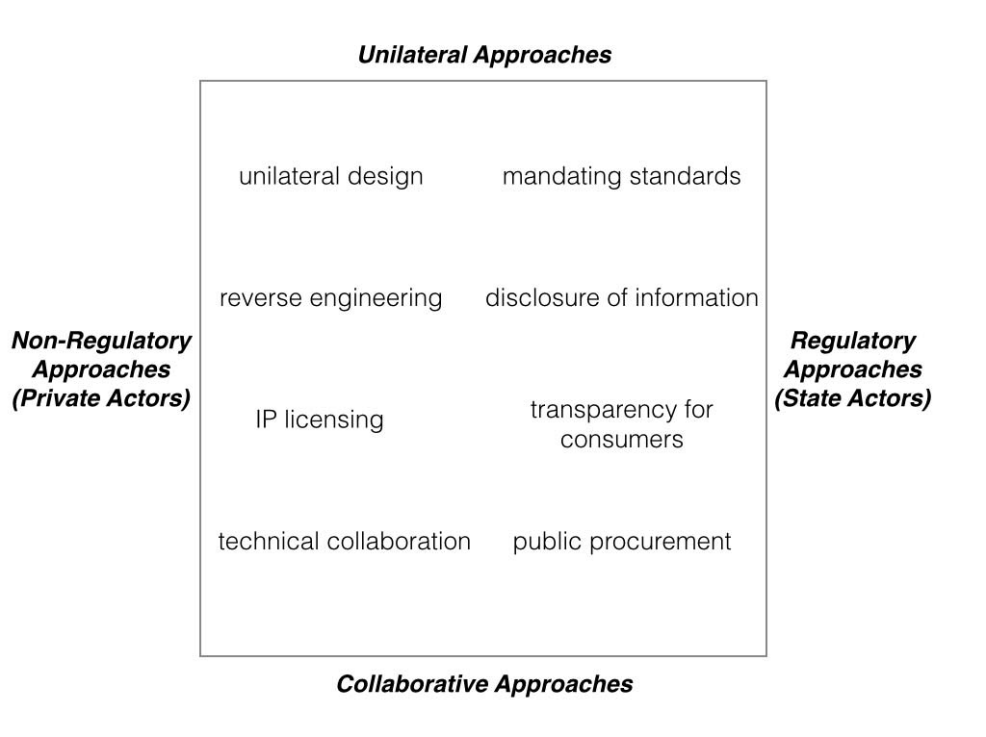
[35] Reuters, *Amazon Kindle Sold 'At Cost,' CEO Jeff Bezos Confirms*, Huffington Post, Oct. 11, 2012, http://www.huffingtonpost.com/2012/10/11/amazon-kindle-lost-leader-bezos_n_1959919.html.

[36] David Streitfeld, *Amazon and Hachette Resolve Dispute*, NY Times, Nov. 13, 2014, http://www.nytimes.com/2014/11/14/technology/amazon-hachette-ebook-dispute.html?_r=0.

[37] *See* Part 3.2, *supra*.

5 Approaches

Figure 5: Approaches to interop



Source: John Palfrey & Urs Gasser, Interop (2012)

As described through several examples above (and others below) there are a variety of approaches to interop. It is useful to think about these approaches along a spectrum from unilateral to collaborative. In other words, there are a variety of ways that entities can incorporate various levels of interop, and those can range from providing an open API (a more unilateral approach) to working with competitors and other stakeholders to create open standards (a more collaborative approach). Moreover, this same spectrum from unilateral to collaborative can be observed across both private actors and state and government actors, including national and transnational regulatory bodies. This spectrum of approaches is laid out in Figure 5 and described in greater detail below. Although the approaches have similarities across both private and public actors, this section compares and contrasts those approaches.

5.1 Non-regulatory approaches (private actors)

Many approaches towards interoperability are based on access to technology or technical specifications, and involve the licensing of IP rights or other contractual agreements. However, the degree of cooperation among different players and the corresponding licensing terms may vary considerably from case to case. The following paragraphs sketch three clusters of approaches to interoperability that range from unilateral to highly collaborative.

5.1.1 Unilateral design and IP licensing

This first cluster of approaches includes those that are marked by a comparatively low degree of collaboration between the systems that are interconnecting. Unilateral design occurs when a market participant designs its products or services in a way that allows other players to offer interoperable products or services. The range of possibilities in this cluster of more "unilateral" approaches is considerably broad.

For example, companies often use APIs as a unilateral invitation for others to interconnect with their systems. In the case of single sign-on digital ID offerings, companies like Facebook offer an open API that any app or online store can utilize, providing they comply with Facebook's rules for accessing the API. Twitter's revocation of its open API is a cautionary tale of how reliance upon unilateral forms of interop may be risky because such forms of interop may be unilaterally withdrawn as easily as they are offered.

Another important and related way to achieve interop with minimal collaboration is through IP licensing, where one party grants to others access to technology, specifications, and/or rights associated with the technology's use. The effectiveness of a licensing approach to interoperability not only depends on the company's willingness to grant a license in the first place, but also on the terms of such a licensing agreement. The scope of and compensation for the license play a particularly important role. Generally speaking, IP licensing tends to be a cost-efficient path toward higher degrees of interoperability, especially in cases where transaction costs are minimized by way of sophisticated and "streamlined" licensing procedures. As to its flexibility, the context-sensitivity of the licensing approach is high, as both parties to an agreement will carefully evaluate the characteristics of the ecosystem. Because of that flexibility, IP licensing tends to be responsive to future technologies. That flexibility, however, may decrease with the widespread adoption of a particular technology. This was precisely the pattern observed in the publishing dispute between Hachette and Amazon. When the market was relatively immature, the licensing agreements between the publishers and e-book makers were fairly simple, largely following existing licensing models. However, as the market matured and Amazon's Kindle became the dominant technical platform, the book publishers feared a loss of flexibility in the licensing terms. It was for that reason that licensing process became far more fraught, and the publishers sought more control over the pricing of their products.

5.1.2 Technical collaboration

Technical collaboration is a more collaborative form of interop. It usually involves some form of IP licensing at its foundation, but technical collaboration is often characterized by a degree of cooperation that goes beyond the mere granting of IP licenses. Often, technical collaboration is an approach to interoperability used by companies at different levels of the value chain in order to improve the user's experience. A significant example of this is the level of cooperation required for many mobile payment systems. As described above, and documented in Figure 2, mobile payment systems require technical cooperation between retailers, device manufacturers, payment processors, and banks.

Technical collaboration shares many of the advantages of IP licensing. It generally appears to be a rather effective, efficient, and flexible approach towards increased levels of interoperability. However, there exist scenarios under which the approach's advantages are smaller. One scenario where this might occur is where the market participants and collaborators grow so large as to make coordination and monitoring costs too difficult or expensive. This challenge has been observed with respect to mobile money markets in some countries. As a recent ITU report described, "In a country with just a few mobile payment operators, it might be possible to do this bilaterally or multilaterally. However, as the number of operators increases, the relationships between them, and the costs of the solution, grow exponentially."[38] Like other approaches, technical collaboration can also be misused to achieve anti-competitive ends that might not be aligned with the goal of an increased overall level of interoperability.

5.1.3 Standards and open standards

Standards are generally characterized as a collaborative approach towards higher levels of interoperability. In some cases, standards are open—an approach to interoperability that has gained much attention in recent times, while its exact definition remains a subject of controversy. In one interpretation,

[38] Venkatesen Mauree, *The Mobile Money Revolution: Part 2: Financial Inclusion Enabler*, ITU-T Technology Watch Report (May 2013), http://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000200002PDFE.pdf, at p. 15.

open standards require that (a) they are approved by formalized committees that are open to participation by all parties and operate on continuous bases, and (b) are made accessible to the public free of charge. In other cases—where participation is not open or the standards are not made public free of charge—the standards are less open. In the health space, both open and less open standards are apparent, sometimes within the same organization or institution. For example, the ITU-T Focus Group on machine-to-machine interoperability, focused largely on e-health applications such as remote patient monitoring, has released an open API and several free reports in order to support the ITU's standardization work.[39] In contrast, the ITU has used a more hybrid approach in the development of ITU-T H.810, standards for the interoperability of personal health systems. In that case, the ITU partnered with Continua Alliance, a non-profit organization that charges for access to its standards.[40]

Standards have a great potential for achieving high degrees of interoperability and are key instruments in the toolbox. However, this approach also can, at times, have limited overall effectiveness. Open standards initiatives are a purely voluntary effort, and anecdotal evidence suggests that companies with patent portfolios might easily interfere or even block such initiatives. Furthermore, standard-setting processes are in many cases complex, time-consuming, and relatively expensive when compared to unilateral or bilateral approaches; arguably, their cost efficiency is therefore comparatively low. With regard to flexibility, standards—particularly open standards that involve more stakeholders in the formation—regularly take into account the characteristics of the specific environment in which they are intended to operate. This means that a standard may represent a snapshot of the state of the art at a particular point in time. Depending on the speed at which technology develops, a standard based on outdated assumptions might restrictively peg future developments to historical limitations.

5.2 Regulatory approaches (state actors)

As Figure 5 notes, Governments and other regulators can also pursue interoperability through a variety of approaches, spanning more unilateral to more collaborative approaches. These approaches also vary significantly with regard to the degree of specificity in which they address the interoperability challenge. On one side are approaches such as mandating standards or requiring the disclosure of interoperability information that are, obviously, very specific in nature. On the other side are more generic interventions like general laws aimed at increasing transparency or competition, but do not address interop specifically. Particularly careful consideration is needed when it comes to interop-specific interventions, while the application of general laws and doctrines is much less problematic.

It is important to note that regulatory approaches can be carried out through a variety of entities that exercise legitimate governance authority over their defined domain. At the country level this could be a legislative body, an executive, or a designated regulator like a telecommunications regulatory authority. At the regional or international levels this could be a multinational body or a coordinating agency like the ITU. The remainder of this paper interchangeably refers to these various entities as "governments" or "regulators." In either case, it is simply referring to any regulatory body that exercises some form of legitimate governmental authority. Across any of these entities, the regulation-based approaches are consistent, and they include:

5.2.1 Mandating standards

Regulators may decide to mandate the adoption of an interoperable standard that ultimately determines how and under what terms entities can interoperate. The role of the regulator in the standard process can itself span a spectrum, from more unilateral to more collaborative. On one end, the regulator

---

[39] *See, e.g.*, ITU-T Focus Group on M2M Service Layer, *M2M service layer: Requirements and architectural framework*, Apr. 2014, https://www.itu.int/dms_pub/itu-t/opb/fg/T-FG-M2M-2014-D2.1-PDF-E.pdf.

[40] ITU-T, *HSTP-H810: Introduction to the ITU-T H.810 Continua Design Guidelines*, July 11, 2014, https://www.itu.int/dms_pub/itu-t/opb/tut/T-TUT-EHT-2014-H810-PDF-E.pdf.

might unilaterally determine the standard. On the other end of the spectrum, the regulator might set a timetable for industry players and require them to establish and implement a common standard. Between the two extremes, all manner of hybrid approaches are possible. The impact of the European Union Data Protection Directive on the development of cloud computing standards, demonstrates the interplay between regulation and interoperable standards. The European Union's Data Protection Directive places strict limits on how personal data can be collected, stored, and processed. However, because the Directive and the national laws that implement it do not specifically address cloud computing, it has left open the question of how cloud-computing companies could fulfill their obligations under the Directive. This set up, even without further intervention from the regulator, has prompted standard setting as entities look for ways to interoperate with each while complying with the law. Recently, the International Organization for Standardization and the International Electrotechnical Commission, two non-governmental standard setting organizations, released a joint cloud computing standard that contributes to the already existing "jungle of standards."[41]

The effectiveness of this type of approach to interoperability is usually very high. A government-mandated standard can even establish an interoperable system in cases where industry players are unwilling to do so, whatever their motives might be. However, a government-mandated approach may be limited in its ability to be efficient and flexible. Administering, monitoring, and eventually enforcing a standard tends to incur considerable costs. Further, a traditional government-mandated approach often leaves very little flexibility. Not only are governments sometimes ill-equipped to choose the most suitable standard, but they also sometimes operate under conditions that make it difficult to respond in due time to market developments or changes in technology.

5.2.2 Disclosure of interoperability information (compulsory licensing)

Another regulatory approach towards interoperability consists of the government mandating the disclosure of information that is essential to build interoperable systems, components, and applications. The terms of such a regime may differ along several dimensions, for instance with regard to the group of people entitled to ask for such information, the possible consideration for the disclosing party, compensation, or the sanctions for non-disclosure. In some cases, however, the regulator can simply require industry participants to make interoperability information available, and leave it to the participants to resolve the details such as consideration or compensation. That is what occurred with mobile banking in Ghana, where the mobile carriers were offering banking services in partnership with banks. In order to ensure interoperability across banks and mobile carriers, the Bank of Ghana (the regulator) prohibited exclusive partnerships. In other words, the regulator required that any mobile operator that partners with one bank, must allow interoperability with another bank. The result of this regulation is that every mobile operator with banking services has at least three partner banks.[42]

The merits of this approach depend largely on its concrete implementation, *i.e.*, the particular design of the relevant disclosure rules. As to the effectiveness, for example, a direct relationship is likely to exist between the amount (and characteristics) of information to be disclosed, the number of parties granted access to the disclosure, and the level of interoperability that may be achieved. Similarly, the efficiency of such rules depends on their specificities. The degree of flexibility also depends on the concrete design, but as a general matter disclosure rules can arguably be implemented in a way that takes factual circumstances into account (*e.g.*, if the obligation to disclose is dependent on market, product and service maturity). Finally, disclosure of interoperability information is very unlikely to create any kind of technological lock-in.

---

[41] Paul de Hert, Vagelis Papkonstantinou, Irene Kamara, *The new cloud computing ISO/IEC 27018 standard through the lens of the EU legislation on data protection*, Brussels Privacy Hub, Working Paper v. 1, N°2, Nov. 2014, http://ssrn.com/abstract=2542125, at p. 7.

[42] Venkatesen Mauree, *The Mobile Money Revolution: Part 2: Financial Inclusion Enabler*, ITU-T Technology Watch Report (May 2013), http://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000200002PDFE.pdf, at p. 16.

5.2.3 Transparency rules (labeling requirements)

In order to reduce potential information asymmetries, the government can use a rather traditional approach aimed at fostering transparency and mandate the disclosure of information about the interop characteristics of a certain product or service. Again, such regulation may vary in several regards, including the characteristics and optical appearance of the information to be disclosed. If the government does not establish transparency rules by way of "specific" legislation addressing interoperability in a certain area, such regulation could be -- and partially already is -- implemented via consumer protection or (unfair) competition law. Although often not mandatory, certification programs often serve this role of bringing transparency to interoperability. For example, after the ITU standardized the home networking standard G.9954 for enabling existing-wire multimedia home networking, the HomePNA association began certifying devices for compliance with the standard.[43] Similarly, the IEEE created a program to certify products that conform to ITU-T Recommendation G.8265.1, relating to synchronization of mobile backhaul networks.[44] In neither case was transparency explicitly mandated, but increasing transparency about interoperability was necessary for those in compliance with the standards to maximize the benefits of their compliance.

Because labeling requirements contribute to interoperability in indirect ways, their effectiveness is difficult to assess. Much depends on the actual design of the labeling provisions and how well they manage to avoid information insufficiency on the one hand and overload on the other. Recent research further suggests that information needs to be embedded in consumer decision-making processes in order to be effective. While there are monitoring and enforcement costs associated with labeling requirements, it is likely that overall efficiency performs better than in the regulatory approaches outlined previously. Finally, the flexibility of labeling requirements is high, given the indirect nature of the approach and, therefore, the limited conflict with future technological developments.

5.2.4 Market power in procurement decisions

The government may favor interoperable products or services when undertaking procurement decisions and thereby provoke or support the market's tipping towards interoperable solutions. Such an approach requires that the government possess substantial purchasing power in the relevant market. This is apparent in the move toward government use of cloud services, where governments are investing significant resources in moving services and data to third-party cloud-based systems. Cloud computing service providers, however, have an interest in making their services as “sticky” as possible to minimize loss of customers to competitors. Ultimately, for the government, this can have the effect of locking itself into a particular cloud service provider. For that reason, governments can try to influence the market by hiring only companies that support data interoperability.[45]

The effectiveness of this approach is high only in instances where a government's procurement decisions have a considerable and lasting market impact. The approach may turn out to be relatively inefficient in cases where the government has to choose between an offer with lower upfront fiscal costs and an offer with higher levels of interoperability. The flexibility of the procurement approach is comparatively low because the exercise of procurement power may create a technological lock-in on the

---

[43] *HomePNA Certifies 9 More Products, 1 Reference Design, Increases Number of Reliable, Interoperable Products to 26*, Business Wire, Apr. 16, 2008.

[44] *IEEE Conformity Assessment Program (ICAP) Announces the Official Launch of the IEEE 1588(TM) Telecommunications Certification Program*, Marketwired, Oct. 9, 2013.

[45] *See generally* Urs Gasser, David O’Brien, *Governments and Cloud Computing: Roles, Approaches, and Policy Considerations*, Berkman Center Research Publication No. 2014-6 (Mar. 7 2014), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2410270.

part of the government (or else cause significant costs if the exercise of procurement power is to be repeated).

5.2.5 Competition law

Interoperability may further be achieved based on an ex post-intervention grounded in competition law. Such an intervention is possible in many countries—although particular conditions may vary considerably—when the refusal of a certain powerful player to disclose interoperability information is considered to constitute an abuse of a dominant position. Even when a company discloses interoperability information at the technical layer, competition law may prevent a powerful player from engaging in anticompetitive practices at the data layer. Whether competition law extends that far is currently the question being tested at the European Commission, which has recently filed a formal antitrust complaint against Google.[46] At issue in the case is how Google interoperates with sites that offer competing shopping services. Although Google will display data from comparison shopping tools that compete with Google's own services, the competitors claim that Google works to drive visitors to its own services. If the European Commission prevails in its case against Google, it will highlight the importance of paying attention to all of the interop layers, and not just the technologic layer.

Antitrust interventions operate with some effectiveness when establishing interoperability in specific areas. However, these interventions run the risk—in view of the duration of the respective enforcement procedures—that they continuously lag behind market development. Further, antitrust measures generally cause significant costs on part of the government that is charged with monitoring and enforcing the law. On the positive side of the balance, however, it has to be noted that the fact-specific and narrowly tailored character of antitrust interventions generally ensures the flexibility of the approach with regard to the market, technological, and legal environment in which it is applied.

5.2.6 Supplementing strategies

In addition to the approaches outlined in this section, governments and regulators also have at their disposal "supplementing strategies." These strategies include things such as the funding of research initiatives aimed at establishing higher levels of interoperability, facilitating standards setting processes, and establishing public-private partnerships that foster interoperability. Although governments and regulators roles may be most naturally oriented toward top-down action, it is important for them to bear in mind the variety of bottom-up approaches in which they can participate, either in more active or passive roles.[47]

5.3 Benchmarks for Interop

Each of the approaches identified above (both private sector and regulatory approaches) has its own features, including strengths and weaknesses or, in more economic terms, associated costs and benefits. One of the particularly tricky tasks is to evaluate them from a policy-oriented perspective and in an unbiased and balanced manner. On an abstract level, the following three benchmarks may be helpful starting place for evaluation. That said, approaches to interop need to be evaluated within their context, which may require developing additional, context-specific evaluation criteria.

5.3.1 Effectiveness

Each approach described above is likely to result in different levels of interoperability and can be expected to play a distinct role in maintaining an interoperable ecosystem. The suggested effectiveness

---

[46] Tom Fairless, Rolfe Winkler, Alistair Barr, *EU Files Formal Antitrust Charges Against Google*, Wall Street Journal, Apr. 15, 2015, http://www.wsj.com/articles/eu-files-formal-charges-against-google-1429092584.

[47] Rolf H. Weber, *Legal Interoperability as a Tool for Combatting Fragmentation*, CIGI (Paper Series No. 4, Dec. 2014).

criterion evaluates the respective contributions and compares the available approaches that are considered in a given situation. Understanding interoperability as a means and not an end in itself, the evaluation of an approach's effectiveness should also consider to what degree the respective strategy tends to enhance competition in the market, foster innovation, or contribute to other policy goals such as consumer autonomy and choice. To be effective, a solution must also provide interoperability over time, not just in the first instance.

5.3.2 Efficiency

In several instances, achieving and maintaining a certain level of interoperability comes with costs. The efficiency criterion seeks to measure the level of costs imposed on an affected player—companies, but also users and governments, among other stakeholders—for a given degree of interoperability and compare it with other available means of achieving interoperability. The costs of unintended consequences (some of them addressed in this paper under the heading "potential risks and drawbacks") also need to be taken into account.

5.3.3 Flexibility

In order to be successful, a given approach to interoperability needs to be able to take into account important factual circumstances that characterize the environment in which it operates. Examples are the market's maturity, product and service maturity, the features of current and future business models, the needs of users, etc. Looking forward, it is particularly important that the approach is responsive to technological development in order to avoid technological lock-in.

Depending on the context, the three benchmarks of effectiveness, efficiency, and flexibility might have different relevance or weight. One might imagine scenarios, for example, where interoperability serves such an important goal (*e.g.*, emergency number compatibility) that flexibility – at least in the short run – is considered to be less important than a high degree of effectiveness in the immediate term. In other instances a government might not want to impose standards given their relatively high costs and poor flexibility, despite the approach's potential effectiveness.

6 Role of governments and regulators

6.1 Role of governments *qua* governments

As noted above, governments and regulators have many possible approaches to fostering interoperability. Given the array of approaches, as well as the necessity of properly matching the approach with the circumstances and context of the situation, it is important to consider how best government can deploy their array of tools in the "interop toolbox."

Of course government can act as a regulator, but it can actually implement interop policy through several other roles. Consider, for example, the following roles that governments have played while pursuing interoperable cloud strategies:[48]

- *Governments as users* – governments are adopting cloud computing services to take advantage of its costs savings and innovative features and in turn using their market power to shape interoperability.

[48] *See generally* Urs Gasser, David O'Brien, *Governments and Cloud Computing: Roles, Approaches, and Policy Considerations*, Berkman Center Research Publication No. 2014-6 (Mar. 7 2014), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2410270.

- *Governments as regulators* – governments acting through their legislative, judicial, regulatory branches to implement policy through the rule of law.
- *Governments as coordinators* – governments coordinating public and private initiatives, through standard setting processes, and by facilitating the sharing of information between private and public stakeholders.
- *Governments as promoters* – governments actively promoting the industry as a whole by endorsement, funding, and incubation programs.
- *Governments as researchers* – governments conducting or funding research on technical or societal issues important for interop.
- *Governments as service providers* – governments providing cloud services for use by other government agencies or the public.

The timing and type of any intervention is a critical consideration for how and when government should take steps to promote interoperability. In its role as a regulator, for instance, governments need to carefully determine the appropriate time at which to intervene, for instance by adjusting consumer protection or privacy laws, in order to strike the right balance between enabling an environment that facilitates technological innovation on the one hand and providing regulatory safeguards for users and other stakeholders on the other hand. Ideally, the government responds to public pressures in making these determinations and engages in a multifactor analysis to determine the right point at which to intervene with the right intervention. Such an analysis would include an assessment of the maturity of the technology, industry organization, and markets.

Even government use of procurement power requires careful consideration. By acting early to influence the market, governments can have the biggest impact on the development of a market and its use of interoperability. As soon as certain industry practices and standards are set, they are much harder to influence. For that reason, some countries have found better results through anticipating needs early and entering the market at the moment where their influence can be most effective.

In addition to the importance of timing interventions in ways that they can be most effective, it is also critical to recognize that technology, markets, strategies, rationales for adoption and promotion *change over time*. The dynamic nature of technologies, such as cloud computing, requires that governments (no matter the role) engage proactively over time with the changing landscape, incorporate a systematic learning process, and adjust their strategies, approaches, and instruments accordingly. The National Institute of Standards and Technology (NIST) at the United States Department of Commerce has been effective at adapting to changing circumstances in its work relating to the development of an interoperable smart grid. One example of this is how the NIST managed the Smart Grid Interoperability Panel (SGIP), a multistakeholder body the NIST convened in 2009 order to help develop necessary standards. Initially, NIST staff held key leadership and technical roles on the SGIP. However, in response to a changing environment and the increased maturity of the smart grid industry, in 2013 NIST transitioned SGIP into an industry-led non-profit organization. By October 2013, SGIP had over 200 members and had finalized 56 standards.[49]

6.2 Role of governments as legal stewards

Governments can also shape an important part of the institutional layer of interop in their role as caretakers of a robust and stable legal environment. The future success of emerging complex systems, such as cloud computing, will depend not just on market forces but also on a well-developed legal framework. This legal framework must establish trust and legal certainty for both users and providers of future interoperable systems.

---

[49] *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0*, NIST Special Publication 1108R3 (Sept. 2014), http://www.nist.gov/smartgrid/upload/NIST-SP-1108r3.pdf.

The relationships between interop and the law are many, complex, and tangled. As described above, the law can help establish, adjust, or maintain interop. At the same time, interoperability is also a feature of the legal system itself, termed *legal interoperability*. Legal interoperability, broadly defined, is the process of making legal norms work together across jurisdictions. This interoperability may occur either within the legal system of a single nation-state—consider federal and state legislation—or across national lines. Like technical interoperability, legal interoperability is not a goal in itself but, rather, a means to one or more ends.

The relationship between law and interoperability is multidirectional. Higher levels of interop are often the product of carefully designed legal interventions—or, at least, are fashioned in the shadow of the law. An example in this category is the enforcement of competition law against powerful technology companies trying to leverage their market power by excluding competitors. The forced disclosure of interoperability information as a matter of consumer protection is another. Conversely, interoperability itself can prompt calls for new laws to address its effects; it may also lead to the adjustment or reinterpretation of existing legal norms. As an example, consider the relation between interoperability and privacy: interoperability in the technology world is giving rise to fresh concerns about data privacy for individuals. In turn, the European Court of Justice expanded existing privacy directives to include a "right to be delisted" that spans across jurisdictions. The changes wrought by higher levels of interoperability in the technology sector are prompting calls for new forms of legal interoperability.

Governments have several options for increasing levels of legal interoperability. As in the case of technical interoperability, the point is not to make the systems all the same but rather to make them work together in particular ways. It is not necessary for countries to turn over all legislative authority to the United Nations or to create a raft of new international laws that govern all jurisdictions. There is no chance that every cultural difference can be smoothed out through harmonization of the law. Nor should it be the goal to create one uniform "world law." Jurisdictions compete productively against one another, and learn from each other, through the creation of heterogeneous legal and policy regimes. Governments need to aim for interoperability among legal systems at an optimal, rather than maximum, level, just as in other interop challenges.

It is important to find the optimal level of legal interop, because evidence suggests that legal interoperability, especially in the information economy, drives innovation, competition, trade, and economic growth. For instance, when China entered into the World Trade Organization in 2001, it had to change a great many laws and enact a number of new ones to satisfy the demands of its trading partners. China has made large-scale changes, for instance, in its system of intellectual property law. Though Chinese law is not the same as intellectual property law in the United States or Europe, it is dramatically closer today than it was a few decades ago.

This level of legal interop, however, comes with challenges. As legal interop increases, companies find it feasible to enter markets that were previously off limits. However, those companies frequently face challenging legal questions that require them to reconcile competing law and interests. For example, as Twitter expanded into more countries, it found itself the recipient of an increasingly large number of demands to remove content. Initially, Twitter responded to these requests by removing Tweets worldwide; if a single country demanded that Twitter remove a Tweet, Twitter would do that for all users, in all markets. However, Twitter eventually decided that one way to address this legal interop challenge would be to use geolocation to remove Tweets only for users visiting from the country that made the legal demand.

Sometimes friction in the form of low levels of legal interoperability may be desirable from a public policy viewpoint. For example, one of the most important considerations for states is cybersecurity. Leaders are extremely concerned about the public security implications of highly interconnected systems. Interoperability of digital systems means that viruses and targeted cyber attacks can have damaging consequences. Viruses and malware frequently take advantage of common, interoperable systems.

Although government-created friction at the *technical* and *data layers* may be controversial,[50] government-created friction in terms of low levels of *legal* interoperability across countries may be both less controversial and beneficial at encouraging a greater diversity of non-interoperable systems that may serve certain defensive purposes.

Legal interoperability is a complex and critical issue, in part because it has the ability to either enable upward mobility in the global economy or to reinforce existing power structures, depending on the choices made. [51]

7 Important issues for the future

Interoperability is not an end in itself. Nor must interoperability always be maximized. Instead, both private actors and regulators must work carefully to optimize the level of interop necessary to meet their objectives. This process of optimization, however, is neither easy nor simple. This paper has described an interop framework, the potential costs and benefits of increased levels of interop, and a variety of approaches for encouraging interop. Thus, when determining the optimum level of interop, all of these factors must be carefully weighed and balanced.

That weighing and balancing is of course necessary from a tactical, outcome oriented perspective, but that perspective can at times obscure the forest for the trees. With emergent and profound new systems and technologies, such as the Internet of Things, quickly becoming more prevalent, it is important to bear in mind some of the big questions and challenges that confront the IoT and other future interoperable technologies. Although these big questions do not yet have good answers, anticipating and considering them now, may help the regulators and others who will struggle with them going forward.

Some of these big questions are:

- **How does society address a proliferation of standards?** In several areas, notably e-health, there is now a ceaseless release of new standards. Some of those standards are no doubt valuable contributions. Many others, however, are conflicting efforts. If standards are generally used to try to bring interoperability to otherwise incompatible approaches, what happens when the sheer number of conflicting standards fragments the market so as to undermine the original goal of interoperability? In the consumer goods market, the solution to this problem is generally to let the standards compete and let the invisible hand of the market choose among the competing standards. But that approach can be expensive, both in terms of time and money. It may also have costs in innovation, as potential market participants wait to invest in the winning standard. For these emerging new technologies and systems, are those costs acceptable? Or is there a way to accelerate the process of choosing the optimal standards from the jungle that is developing?
- **How can interop better manage complexity and scale?** As described above, higher levels of interop can lead to highly complex systems. This complexity and scale, however, has many costs. It can make it hard to identify and correct failures. It can create security risks and magnify the impact of vulnerabilities. At certain scales, it can even represent a form of lock-in, as network effects become predominant. In many ways, successful interop can be its own worst enemy. How can interop better mitigate these problems so as to fully capitalize on the societal gains of large-scale interop?
- **How can highly interoperable systems better communicate to end-users?** As described above, end-users often do not know where to turn when something goes wrong in a highly interoperable

[50] Cory Doctrow, *Crypto wars redux: why the FBI's desire to unlock your private life must be resisted*, The Guardian, Oct. 9, 2014, http://www.theguardian.com/technology/2014/oct/09/crypto-wars-redux-why-the-fbis-desire-to-unlock-your-private-life-must-be-resisted.

[51] Rolf H. Weber, *Legal Interoperability as a Tool for Combatting Fragmentation*, CIGI (Paper Series No. 4, Dec. 2014).

system. If a system behaves like a single, cohesive unit, that is both a success for interop and an obfuscation to the end user. This presents a challenge for interop even under the best of circumstances, where the end-user might have access to greater parts of the system and interact with the system through highly complex interfaces. However, in the Internet of Things or the wearables market, end users are less likely to have access to large parts of the system and the interface may be as small as a watch face. In those challenging circumstances, how can interoperable systems better communicate to end-users?

- **How do issues of surveillance and national security factor into the interop calculus?** When regulators and governments are weighing whether and how to intervene in order to encourage higher levels of interop, to what extent should surveillance and national security factor into that decision? Just as the Internet is value neutral and can be deployed in ways that benefit society and are detrimental to it, so too is interop. Higher levels of interop do not inexorably lead to more surveillance or less, for example. Greater levels of interop can create both a higher risk of surveillance and greater threats to national security, in ways that can be beneficial offensively and threatening defensively. How then do regulators and governments approach issues of interop when considered through the lens of their broader roles and responsibilities?
- **How do regulators optimize interop while operating within the constraints of their complex political environments?** Although regulators and governments have many traditional means of increasing levels of interop (*e.g.*, mandating standards, passing legislation), this paper has highlighted many of the other approaches that exist with the regulatory toolbox. Indeed, in many cases, the alternative means approaches may be the most effective at optimizing interop. Regulators and governments, however, have many constituencies with competing interests. The balancing described in this paper is challenging enough in a vacuum, but is more so in the real world. For example, an agency may feel political pressure to demonstrate big, decisive action, when a more light-handed approach would actually better optimize interop. How then can regulators and governments best take into account their constraints while still optimizing interop?

The answers to these questions are not simple, but wrestling with them will be critical for designing the next generation of interoperable technologies.

Appendix 1: Suggested additional readings

In the text in order to keep the reading experience streamlined, this paper cites a relatively small number of works. A glance through those few notes hints at the wider range of work of academics, practitioners, and regulators that has already gone into seeking to understand this phenomenon. In addition to the notes cited above, below are a selection of other readings that offer a starting point for readers who want to dig deeper into the topic of interop.

Stacy A. Baird "Government Role and the Interoperability Ecosystem" (*I/S: A Journal of Law and Policy* 5, no. 2 [2009]: 219–290).

Yochai Benkler, *Wealth of Networks* (2006).

Yochai Benkler, *The Penguin and the Leviathan: The Triumph of Cooperation over Self-Interest* (2011).

Laura DeNardis, *Opening Standards: The Global Politics of Interoperability* (2011).

"Network Effects," in David Easley and Jon Kleinberg, *Networks, Crowds, and Markets: Reasoning About a Highly Connected World* (2010).

Urs Gasser and John Palfrey, *Interop* (2012).

Marc Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger* (2006).

Viktor Mayer-Schoenberger, "Emergency Communications: The Quest for Interoperability in the United States and Europe" (Kennedy School of Government Faculty Research Working Papers Series RWP02–024, March 2002).

John Palfrey, *Intellectual Property Strategy* (2011).

Hal Varian, Joseph Farrell, and Carl Shapiro, *The Economics of Information Technology* (2004).

Rolf H. Weber, "Legal Interoperability as a Tool for Combatting Fragmentation," CIGI (Paper Series No. 4, Dec. 2014).

Jonathan Zittrain, *The Future of the Internet and How to Stop It* (2008).

DIGITAL INCLUSION

Model ICT accessibility POLICY REPORT

Report

Telecommunication Development Sector

Model ICT accessibility policy report

November 2014

This International Telecommunication Union report was prepared in cooperation with the G3ict, the Global Initiative for Inclusive ICTs, under the supervision of the ITU Telecommunication Development Bureau (BDT) Special Initiatives Division.

Lead Authors:
ITU expert Mandla Msimang was the lead author of this report. G3ict experts Dónal Rice and Clas Thorén authored the model accessible ICT public procurement policy framework module.

Contributors:
Axel Leblois, Founder and Executive Director of G3ict
Susan Schorr, Head, Special Initiatives Division

Reviewers:
The development of the ITU-G3ict model policies would not have been possible without the input of experts involved in developing, promoting and implementing ICT accessibility solutions as regulators, advocates or industry participants, and the following reviewers are gratefully acknowledged for their invaluable contribution, advice and support:

Gunela Astbrink, GSA InfoComm (Australia)
Francesca Cesa Bianchi, G3ict, Global Initiative for Inclusive ICTs
Judy Brewer, W3C – WAI
Simão Campos, ITU-T
David Capozzi, U.S. Access Board
Kevin Carey, Royal National Institute for the Blind (U.K.) and World Blind Union
Monica Duhem, Hearcolors (Mexico)
PJ Edington, IBM
Chiara Giovannini, ANEC (Belgium)
Larry Goldberg, Carl and Ruth Shapiro Family National Center for Accessible Media at WGBH (United States)
Sven-Eric Hargeskog, Swedish Development Agency (Sweden)
Alex Li, Microsoft Corporation
Peter Looms, Danish Broadcasting Corporation (retired), Chair of the ITU-T Focus Group on Audio Visual Accessibility (Denmark)
Ileana M. Martinez, Standards Coordination Office, National Institute of Standards and Technology (United States)
Phosa Mashangoane, Independent Communications Authority of South Africa (South Africa)
Susan Mazrui, AT&T
Mary Jo Mueller, IBM Research, Human Ability & Accessibility Center
Pilar Orero, HBB4All (Spain)
Robert Pearson, Accessible Media Inc. (Canada)
Andrea Saks, ITU-T Joint Coordination Activity on Accessibility and Human Factors
Karen Peltz Strauss, Federal Communications Commission (United States)
Anne Marie Rohally, Microsoft Corporation
James Thurston, Microsoft Corporation
David Wood, European Broadcasting Union (Switzerland)

Please consider the environment before printing this report.

© ITU 2014

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Foreword

ICT accessibility for persons with disabilities is a priority for ITU members. At the last ITU World Telecommunication Development Conference (WTDC) ITU members recognized the need to ensure that the one billion people living with some form of disability can use information and communication technology (ICT) for their empowerment. How do we make ICT accessibility a reality?

ICT accessibility means removing barriers so that persons with disabilities can use ICTs. The barriers faced depend on a person's disability. Our previous publications, *Making mobile phones and services accessible* and *Making television accessible* have documented the accessibility needs of persons with visual, hearing, mobility, dexterity, and cognitive disabilities.

One of the key steps to make ICT a reality is to establish an enabling environment for ICT accessibility, just as nations have established enabling environments to authorize competition in the provision of ICT services. A little over ten years ago, countries around the world created policy and regulatory frameworks that unleashed unprecedented growth in mobile and Internet use. These frameworks led to universal access and service levels beyond the imagination of policy-makers in earlier years: by the end of 2014, we expect nearly 7 billion mobile phone subscriptions and almost 3 billion Internet users.

Despite these advances, very few nations today have acted to ensure that persons with disabilities are part of this technology revolution. Persons with disabilities continue to face barriers in using ICTs. I believe that creating and implementing national ICT accessibility policy frameworks will lead to unprecedented growth in accessible ICTs and the empowerment of persons with disabilities. The impact of these policies will be enjoyed by many others, including immigrants, aging and illiterate populations, and will open doors to inclusive education, employment and health services.

This *Model ICT accessibility policy report* is designed as a tool for national policy-makers and regulators to create their own ICT accessibility policy frameworks. It includes six modules focusing on different aspects of ICT accessibility (amendments to the existing ICT legal framework, public ICT access, mobile communications, television/video programming and public procurement of accessible ICTs) so that countries can prioritize implementation. In all modules the approach is to develop national policies in consultation with persons with disabilities.

ITU members, in the Final Report of WTDC-14, requested ITU to assist them in formulating national and regional policy and regulatory frameworks on ICT accessibility. It is my hope that this report will serve as a valuable resource for ITU members and all stakeholders as they strive to implement successful ICT accessibility policies in their countries. My sincere appreciation goes to our colleagues at G3ict with whom we developed this report, along with the authors and all the stakeholders who provided invaluable comments on the report.

I am convinced that we can make ICT accessibility a reality. Let us now move from words to action and begin formulating, implementing, and monitoring ICT accessibility policies in close consultation with persons with disabilities.

Brahima Sanou

Director

Telecommunication Development Bureau

Publisher's note

This report represents the culmination of seven years of cooperation between the International Telecommunication Union and G3ict, the Global Initiative for Inclusive ICTs, in gathering good practices and facilitating exchanges among policy-makers, organizations of persons with disabilities representatives and industry leaders promoting the accessibility of information and communication technologies (ICTs) in compliance with the dispositions of the United Nations Convention on the Rights of Persons with Disabilities.

Translating those dispositions into policies, laws and regulations requires a carefully crafted ICT accessibility enabling framework. Different types of ICT equipment and services, ranging from public ICT access points, mobile devices and services, television and video programming and equipment, web sites as well as all ICTs purchased via public procurement require distinct accessibility solutions involving different groups of stakeholders. These solutions can be achieved through common approaches, leveraging technological innovation and the adoption of international standards that ensure economies of scale that offer considerable opportunities for persons with disabilities. Each module calls for a common approach of defining detailed implementation plans and execution of well-defined targets based upon ongoing consultations among industry, service providers, organizations of persons with disabilities, standards development organizations, and policy-makers and regulators.

Thus, the six modules of this report, while offering policy frameworks inspired by existing good practices and available technologies from around the world, all emphasize the critical importance of setting up processes involving relevant stakeholder in developing and monitoring ICT accessibility policies with persons with disabilities.

Within the UN System, the ITU leadership in promoting ICT accessibility plays an important role in realizing the promises of the Convention on the Rights of Persons with Disabilities. The development of this report would not have been possible without the strong commitment to ICT accessibility of the entire ITU executive team, the support and encouragements of Mr Brahima Sanou, Director of ITU Telecommunication Development Bureau (BDT) and the energy and dedication of Ms Susan Schorr, Head of ITU-D Special Initiatives Department who oversaw this project and ensured that its contents meet ITU membership needs.

The editing and review process of this report, after the successful completion of the joint ITU-G3ict e-Accessibility Policy Toolkit for Persons with Disabilities, demonstrate once more the benefits of multi-stakeholder participation. Our sincere appreciation goes to all contributors and module reviewers who have contributed their wisdom and experience to this report and to Ms Mandla Msimang, our lead author, who has applied her energy to completing this monumental task with an in-depth knowledge and understanding of regulatory and policy development processes.

It is our hope, that these model policies will facilitate faster, more effective ICT accessibility policy developments around the world, and set the stage for effective multi-stakeholder engagement in promoting accessible ICTs, an essential enabler of the Rights of Persons with Disabilities in our digital world.

Axel Leblois

President and Executive Director

G3ict

Table of contents

Page

Module 1: ICT accessibility legal, policy, and regulatory framework 1

1. Options for regulation 2
2. Technology and standards 5
3. Review of definitions in existing ICTs 5
4. Promoting participation by persons with disabilities in policy-making – Recommendations 7
5. Universal access and service (UAS) framework 10
6. Quality of service for ICT accessibility – Recommendations 12
7. Emergency services – Recommendations 13
8. Targets and reporting requirements 14
9. Changes to disability/disability rights legislation – Recommendations 15
10. Periodic review 15

Module 2: ICT accessibility framework on public access 16

1. National mandate 18
2. Objectives 18
3. Awareness 20
4. Provision of public access communications services 20
5. Physical environment accessibility 21
6. Emergency services 22
7. Training 22
8. Targets and reporting requirements 22
9. Periodic review 23

Annex A: Model licence conditions/universal service obligations on public ICT accessibility for persons with disabilities 24

Annex B: Checklist on accessible public access facilities 26

Module 3: Mobile communications accessibility policy framework 28

1. Definitions 30
2. Effective date and application 31
3. National mandate 31
4. Sales, retail outlets, customer care and public awareness 33
5. Products, services and devices 34
6. Applications 35
7. Special and/or discounted rates and plans 36
8. Emergency services 37

Page

9. Assistive technologies ... 38
10. Funding and incentives (universal service and access fund) ... 38
11. Targets and reporting requirements ... 40
12. Periodic review ... 42

Annex A: Model code of conduct on mobile communications accessibility for persons with disabilities ... 43

Annex B: Regulations in terms of section [X] of the [ICT law] for mobile communications accessibility for persons with disabilities ... 52

Module 4: Television/video programming accessibility policy framework ... 59

1. Definitions ... 61
2. Effective date and application ... 62
3. National mandate ... 63
4. Objectives ... 64
5. Awareness and customer service ... 64
6. Television/video programming access ... 65
7. Captioning ... 67
8. Signing ... 68
9. Audio description and audio subtitles ... 68
10. Quality of service ... 69
11. Equipment ... 69
12. Electronic programme guides ... 70
13. Emergency services ... 71
14. Funding ... 71
15. Exemptions ... 72
16. Representation and portrayal of persons with disabilities ... 72
17. Targets and reporting requirements ... 73
18. Periodic review ... 73

Annex: Sample regulations ... 74

Module 5: Web accessibility policy framework ... 75

1. Definitions ... 78
2. Preamble ... 78
3. Effective date and application ... 79
4. National mandate for web accessibility ... 80
5. Objectives of the web accessibility policy ... 81
6. Awareness ... 82
7. Compliance of public sector websites with web accessibility standards ... 82

Page

8. Assessment of existing public sector websites and accessibility transition plans 83
9. Conformance levels for public websites 84
10. Retroactive application and existing content of public websites 84
11. Electronic documents available on public websites 85
12. Dispositions for the private sector and civil society 85
13. Responsibilities for the implementation of the policy 85
14. Targets and reporting requirements 86
15. Periodic review 87

Annex A: List of public sector web sites and responsible agencies or organizations covered by the web accessibility policy as of its publication 88

Annex B: Resources for policy implementation and technical references 89

Annex C: Web Content Accessibility Guidelines 2.0 91

Module 6: Accessible ICT public procurement policy framework 92

1. Definitions 95
2. Introduction to accessible ICT public procurement policy 96
3. Objectives 98
4. Roles and responsibilities 100
5. Training, capacity building and awareness raising 101
6. Defining accessibility as an attribute in the procurement of ICT 101
7. Accessibility in the preparatory study 102
8. Requesting information in the Call for Tender on a supplier's accessibility capability 103
9. Use of standards for formulating accessibility requirements 104
10. Including accessibility as a criterion in the Call for Tender for 'off the shelf' products 104
11. Including accessibility requirements in procurement for the development of products and services 105
12. Verification of compliance with accessibility criteria in the Call for Tender 105
13. Accessibility in contract clauses 107
14. Accessibility in contract management 107
15. Exemptions 107
16. Monitoring and evaluation 108
17 Periodic review 108

Annex A: Standards 109

Annex B: Functional performance statements 110

Annex C: Example of product accessibility template 113

Annex D: Training materials and resources for use in awareness raising, capacity building and training in public procurement of accessible ICT 115

Objectives of this report

The *Model ICT accessibility policy report* is developed for information and communication technology (ICT) policy-makers, regulators and other stakeholders active in ICT and/or disability issues, including non-governmental organizations (NGOs), organizations of persons with disabilities, and parliamentarians. This report addresses a range of facets of the ICT sector and is designed to assist in policy making in public ICT access, mobile communications, television/video programming [1], web accessibility and public procurement. It also provides a framework for countries to develop policies, through legislation, regulations, standards, and guidelines, to provide an institutional framework for ICT accessibility. It recognizes that in many instances, and in particular with reference to a disability policy framework, "soft law" or voluntary initiatives, negotiated roadmaps, codes of conduct, and compliance can also be effective in promoting equitable access to information and communications technologies for persons with disabilities in a fast changing technology environment; as such it provides guidance on both regulatory and voluntary approaches.

This report has been prepared pursuant to the United Nations Convention on the Rights of Persons with Disabilities (hereinafter the Convention) and in line with the International Telecommunication Union (ITU) and G3ict ICT Accessibility Policy Toolkit for persons with disabilities (www.e-accessibilitytoolkit.org). Successful achievement of the goals set out in the Convention relies on the adoption and early implementation of policies by a country. Each country has to decide on the respective policies and an implementation timetable in accordance with its unique circumstances. This report will assist countries to understand the generic steps and requirements necessary to promote accessibility by persons with disabilities and provides guidance in areas where they can be adapted to meet national circumstances.

The UN Convention on the Rights of Persons with Disabilities

The UN Convention on the Rights of Persons with Disabilities addresses the risks of exclusion of persons with disabilities from participating equally in society by defining ICT accessibility as integral to general accessibility rights and on a par with accessibility to the physical environment and transportation. It came into force in May 2008 and enshrines the principle that persons with disabilities must be able to enjoy human rights and fundamental freedoms on an equal basis with others. It is the first international human rights treaty requiring that information and communications technologies and systems be accessible as a necessary condition for persons with disabilities to fully enjoy these fundamental rights without discrimination. Its dispositions provide a human rights foundation for existing policies and programmes developed by countries, such as universal service and access policies for telephony, video programming and/or web accessibility, and set a clear roadmap for State Parties lacking such policies.

Article 9 of the Convention sets out general obligations for States Parties to ensure that persons with disabilities have access to information and communication technologies and systems. Articles 21, 29 and 30 expand on this and refer to media, communications and ICTs serving as platforms for furthering the rights of persons with disabilities to freedom of expression and opinion, access to information, participation in political and public life and participation in cultural life, recreation, leisure and sport. These Articles collectively call for all content, communication, information, hardware, software and interfaces to be accessible. They further call upon States Parties to encourage the private sector to deliver accessible products and services.

[1] The television/video programming accessibility policy framework module addresses all forms of video programming whether transmitted over traditional broadcasting, digital and IPTV, cable, satellite TV, HBB TV (hybrid broadcast broadband TV) or IBB (integrated broadcast-broadband system) networks. The approach is technology neutral and whatever the platform the aim of the policy is to ensure that persons with disabilities face no barriers in watching programmes or using electronic programming guides (EPGs), remote control devices or TV devices across all platforms.

Accessibility is identified in Article 3(f) of the Convention as one of its eight general principles, and accessibility, including access to ICTs, is established therein as a condition that will enable persons with disabilities to exercise their fundamental freedoms and human rights.

Article 2 defines "communication" in an inclusive manner to include all possible means of communication "languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communications technologies" that can eliminate barriers for persons with disabilities to enjoy their fundamental freedoms and human rights.

The vast majority of ITU Member States had ratified the Convention at the time of publication of this report.

Challenges for persons with disabilities

Information and communication technology (ICT) laws, policies and regulations generally support the principles of universal access to information and communication technology. They do this by focusing on providing a framework to facilitate the deployment of ICT networks, the promotion of affordable services and products, the protection of consumers, and the provision of reliable emergency services. Laws are meant to address the needs of *all* users. However, in practice, while these issues are relevant to users with disabilities, the needs of the disability community are different and require a deliberate additional focus on *accessibility* by legislators, policy-makers and regulators.

Some of the challenges faced by persons with disabilities, and included in the various modules of this report, require that:

- Accessible ICTs (i.e. access to end-user equipment, such as mobile handsets, televisions, tablets and computers), offer features to enable persons with disabilities to use ICTs effectively. There are often challenges with respect to the availability and affordability of this equipment that, when obtainable, may be at an additional cost to the end user. Even where there is no additional cost, and accessibility features are embedded (for example in mobile handsets), awareness, training and education of both users and service providers are often required in order to break the accessibility barrier.
- Access to assistive technologies are free or available at a low cost through subsidies or grants. Again there is a need for training of persons with disabilities and those who assist them on the use of technologies and features made available.
- Products and tariff plans are structured in a way that recognize the ways that persons with disabilities use services – for example, text-only mobile communications packages for deaf or hearing impaired users.
- Access to services and interfaces ensures that content on television, the Internet or in other electronic media is available in accessible formats – for example, through the use of closed captions for users who are deaf or hard of hearing and audio description for users who are blind or visually impaired. There also need to be awareness campaigns on the availability of accessible content.
- Access to customer services addresses the specific needs of persons with disabilities.

Addressing key issues in promoting ICT accessibility

Bearing in mind the challenges faced by persons with disabilities, this report sets out good practice for policy development and implementation across a range of ICT sub-sectors, namely public communications, mobile communications, television/video programming, the Internet and public procurement. In each module, the following good practice principles are advanced:

- **Mainstreaming ICT accessibility** through inclusive language, definitions and provisions in policies, laws and regulations; and through including persons with disabilities as beneficiaries of universal

service and access funds (USAFs) or any other funding mechanisms or programmes relating to the ICT sector[2] and extending the goals of universal service/access to include accessibility in addition to affordability and availability of ICT services.

- **Identifying key steps** that can be taken quickly to promote ICT accessibility, such as ensuring accessible devices (such as public and mobile phones and television sets) are available.
- **Awareness-raising among key stakeholders** by promoting ICT accessibility through public outreach programmes, working with industry to develop universally designed products and gathering and publishing reports on developments with respect to ICT accessibility.
- **Consensus building and inclusive policy-making** through encouraging national debate and discourse, by setting up specialized fora and committees, through inclusive regulation-making and public consultation processes and encouraging voluntary codes of conduct and charters.
- **Collaborative efforts** through the promotion of public-private-partnerships, encouraging the use of universal service fund subsidies and promoting other partnerships to stimulate research and development in the industry for example voice recognition and text-to-speech interfaces in local languages – to ensure local relevance and uptake
- **Promoting the setting of clear targets, and periodic reporting to monitor implementation** and by ensuring that there is clear delegation of responsibility, including identifying who is responsible for what aspects of the promotion of ICT accessibility.
- Encouraging training, capacity building and educational programmes on disability awareness.

Organization of this report

Since technologies and ICT environments are constantly evolving, the Convention has defined obligations in relation to desired outcomes by application areas, rather than in specific technical terms. In line with this, this *Model ICT accessibility policy report* recognizes that it is up to policy-makers, regulators, civil society and industry to identify and define solutions specifically tailored to their individual country's needs, while leveraging to the greatest possible extent international standards and global economies of scale to lower costs and to promote interoperability.

This report also recognizes that, depending on a country's legal and institutional framework, responsibilities for various aspects of ICT policy and regulation may rest with different bodies, hence the possible need for more than one policy in a country. It furthermore acknowledges that in order to have a comprehensive framework to address ICT accessibility, a range of tools may be required, including laws, policies, regulations, standards, self-regulatory/co-regulatory codes, and guidelines, where applicable. As such, this report is set out in six modules, each of which covers the basic tools that policy-makers and regulators need to consider in order to improve ICT accessibility:

- **Module 1: ICT accessibility legal, policy and regulatory framework** provides an overview of key provisions that should be included in primary ICT legislation in order to mainstream ICT accessibility in a national regulatory and policy framework.
- **Module 2: ICT accessibility framework on public access** includes model licence conditions, guidelines and a public access accessibility checklist.

[2] Other funds can be used to promote television/video programming accessibility, including, production or cultural industry promotion funds. Ideally such funds would only be used for accessibility content production. An example of this type of fund would be the Broadcasting Accessibility Fund established by the Canadian Radio-television and Telecommunications Commission Policy CRTC 2012-430. Other more general funds include the Media Development and Diversity Agency (MDDA) which fund the media and broadcasting industry in South Africa.

- **Module 3: Mobile communications accessibility policy framework** provides a model policy that is supported by a model code of conduct, and model provisions that intended to be included in regulations to be used depending on the legal framework of a country.
- **Module 4: Television/video programming accessibility policy framework** includes a model policy as well as an annex with references to television/video programming accessibility regulations from selected countries.
- **Module 5: Web accessibility policy framework** sets out a model policy and provides readers with resources for policy implementation, and technical references.
- **Module 6: Accessible ICT public procurement policy framework** includes a model policy, and sets out functional performance requirements as well as a product accessibility template, and training and resource materials.

These six modules are designed to assist in developing policy for public ICT access, mobile communications, television/video programming[3], web accessibility and public procurement. Some areas of ICT accessibility and assistive technologies such as those specific to education, employment, rehabilitation, local government, voting, financial services or transportation are not covered in the modules in this report. Consultations and coordination on ICT accessibility matters in relation to these areas is nevertheless very much encouraged in order to share resources, solutions and capacity building programmes.

There is a trend in regulation and policy making toward convergence and technological neutrality. However, because the accessibility needs and requirements of persons with disabilities vary by type of ICT (e.g. computers in public access centres, mobile telephony, TV, and websites), this report is organized to address these specific requirements.

Each module in this report can either be used to develop a stand-alone policy, or can be merged with other modules where a single ICT authority is responsible for telecommunications, electronic communications, television/video programming services, and/or web accessibility. However, even in such scenarios, it may be desirable to accessibly publish separate policies, depending on the development of the market and the level of overlap between the suppliers of such services. For example, it may be easier to enforce compliance if licensed service providers of video programming[4] and regulators only concern themselves with a television/video programming-specific accessibility policy (see the model television/video programming accessibility policy) and mobile communications service providers or ICT/telecommunication regulators with a mobile accessibility policy (see the model mobile communications accessibility policy). The decision is left to the implementing country. This report uses the term "ICT" to include telecommunications, electronic communications, the Internet and television/video programming.

Designed and drafted on the basis of a similar approach, each module:

- explains ICT accessibility goals to be achieved and the steps required to achieve those goals;
- provides national policy-makers and regulators with a generic approach that can be adopted, and model text that can be used and amended to meet the needs of a particular country;
- includes annotations to assist countries to understand the basis for some of the proposed clauses (e.g. obligations that originate from the Convention are noted in Module 1 and the model policies to assist signatories to ensure compliance with the Convention);

---

[3] The television/video programming module addresses all forms of video programming whether transmitted over traditional broadcasting, digital and IPTV, cable, satellite TV,HBB TV (hybrid broadcast broadband TV) and IBB (integrated broadcast-broadband system) networks. The approach is technology neutral and whatever the platform the aim of the policy is to ensure that persons with disabilities face no barriers in watching programmes or using electronic programming guides (EPGs), remote control devices or TV devices.

[4] The Model television/video programming accessibility policy in Module 4 uses the term "licensed service provider" to refer to the entity responsible for delivering television/video programming according to each national legal and regulatory framework, including broadcasters, cable and satellite network operators and other licensed video programming services intended for reception by the public.

- provides annotations which highlight issues for countries to consider in adapting Module 1 and the model policies to meet their national requirements (e.g. specific considerations such as population, literacy, institutional framework, and adopted standards); and
- includes appendices with supporting tools, such as useful information for national policy-makers and regulators who are not familiar with ICT accessibility policy, guidelines, checklists, and examples of existing policies and model codes of conduct or model regulations, as applicable depending on the topic and jurisdiction.

This report therefore includes a comprehensive range of information to assist legislators, regulators and policy-makers to draft comprehensive and sound accessibility policies specific to their particular country needs and circumstances, taking into account technological developments. Because of the rapidly changing technological environment, countries are encouraged to put in place mechanisms and processes to conduct periodic reviews of their policies and legal instruments to ensure they best harness and address new technological opportunities to promote ICT accessibility.

Module 1: ICT accessibility legal, policy, and regulatory framework

This module can serve as a tool to assist policy-makers by identifying amendments to existing ICT sector legislation that will promote ICT accessibility. The rationale for this approach is based on the United Nations Convention on the Rights of Persons with Disabilities (hereinafter, the Convention), which in its Preamble states that mainstreaming disability issues in all frameworks is "an integral part of relevant strategies of sustainable development".

Information and communication technology (ICT) sector policy and legislation provides guidance to national regulatory authorities (NRAs) and other governmental bodies in their policy-making and regulation-making in relation to ICT. The policy and law set out the requirements of the relevant institutions, as well as the boundaries of their mandates. Ministries and NRAs often cannot make policies or regulations in the absence of the "enabling statutes" despite a will to do so.

This report therefore provides policy-makers and legislators with background information on the ICT accessibility aspects of key ICT legal, policy and regulatory measures as well as legal and policy recommendations and model clauses that can be included in existing legislation to ensure that the needs of persons with disabilities are an integral part of the ICT legal framework and flow into the policy and regulatory framework.

Many countries are in the process of amending their telecommunication, broadcasting or ICT legislation to address issues such as convergence and the introduction of broadband. This document can serve as a tool to ensure that, in that process, key amendments to promote accessibility are incorporated into new laws. Alternatively, policy-makers may wish to initiate amendment processes to their existing laws specifically to promote ICT accessibility.

In developing legislation, policies, regulations or implementing "light touch" strategies such as voluntary codes of conduct, the involvement of organizations of persons with disabilities is crucial. The Convention stipulates that:

> *In the development and implementation of legislation and policies to implement the present Convention, and in other decision-making processes concerning issues relating to persons with disabilities, State Parties shall closely consult with and actively involve persons with disabilities, including children with disabilities, through their representative organizations*[5].

As such, this module includes proposals relating to the inclusion of persons with disabilities in rule-making and ensuring that all documents issued by regulators and policy-makers are accessible.

The module begins with an overview of different regulatory approaches in use by countries around the world, ranging from "light touch" regulatory frameworks that include industry self- and co-regulation to more traditional regulatory approaches that require the promulgation of regulations. It then goes on to identify changes necessary in existing ICT legislation to promote ICT accessibility for persons with disabilities, including definitions, ways to ensure that persons with disabilities are included in consultative processes for the development of ICT accessibility frameworks, universal access and service frameworks, consumer protection, emergency communications, and reporting requirements. It also includes a section on changes necessary in disability legislation or disability rights laws.

The goals of the legal, policy and regulatory approaches identified in this module are to create a legal and regulatory framework that promotes ICT accessibility by taking the following steps:

- revising existing ICT policies, legislation and regulations to promote ICT accessibility;
- consulting with persons with disabilities on the development of such revised ICT policies, legislation and regulations, including by establishing a committee on ICT accessibility;

[5] See Convention on the Rights of Persons with Disabilities, Article 4 "General Obligations", paragraph 3.

- making persons with disabilities and organizations of persons with disabilities aware of revised ICT policies, legislation and regulations;
- adopting ICT accessibility technical and quality of service standards;
- adding and revising key ICT legislation definitions to promote ICT accessibility;
- amending the universal access/service legal and regulatory framework to include ICT *accessibility* as an explicit goal of universal access/service and the universal access/service fund;
- ensuring that quality of service requirements take into account the specific needs of persons with disabilities and set quality of service standards for accessible services;
- revising legal frameworks for emergency communications to ensure emergency services are accessible for persons with disabilities;
- establishing clear targets and report annually on their implementation; and
- amending disability legislation to refer to ICT accessibility.

Section 1 of this module – options for regulation - is provided for background, especially for ICT accessibility stakeholders who are not familiar with ICT regulatory options; it also explains the range of regulatory approaches that are used in modules 2 and 3. Recommendations are provided throughout and model legal texts can be found in Boxes 1, 3, 4, and 5.

1. Options for regulation

This report recognizes that different regulatory frameworks require different approaches to promote ICT accessibility. The report therefore provides model provisions that are flexible enough to be used in different kinds of regulatory frameworks. In some regulatory regimes, for example, ICT accessibility requirements will be included in licence conditions, while in others they may be included in general regulations. Where countries allow for self or co-regulation, ICT accessibility can be achieved through codes of conduct. It also explains which regulatory tools will be most effective to reach the desired results, depending of course on the country's legal framework and the structure of the industry.

Recognizing these differences, modules 2 and 3, on public ICT access and mobile communications respectively, provide model codes of conduct and model regulations that can be adopted depending on a country's legal and regulatory framework.

a. Background on the roles of the policy-maker and the regulator

The relevant ministry is generally responsible for making policy which governs the ICT sector. ICT accessibility policies therefore need to be made by the responsible ministry and included in the general policy framework. The policy sets out the government's intent and contains its broad vision and objectives, in this case, for ICT accessibility. Although policies are formally put in place by governments, different stakeholders, including the regulator, the private sector, civil society and organizations representing persons with disabilities, make inputs into the policy process and affect its outcomes. Policy needs to be turned into legislation, regulations, and/or licence conditions in order to make it enforceable.

The role of the regulator facilitating ICT accessibility according to EPRA (European Platform of Regulatory Authorities), ranges from implementing policy through drafting and enforcing regulations, setting targets and licence conditions, monitoring and enforcing obligations, drafting or approving of codes of practice and driving awareness campaigns and consultation. There should always be alignment between policy and the instruments used to implement it – although the instruments contain more detail.

The following background sections on ICT regulatory options for ICT accessibility stakeholders will lead to a better understand the regulatory options provided in modules 2 and 3 by those who are not familiar with ICT regulations.

b. Background on licence conditions/authorizations

In order to operate in the ICT sector, providers require licences which authorize them to provide specified services (which may also include multiple services, usually technology neutral) under conditions that are agreed between the issuing authority (usually the NRA) and the licensee. A "licence" or "authorization" is a general term applied to all the legal instruments (including concession agreements) used to facilitate entry to ICT markets for services (including content services) and networks[6]. These legal instruments set out the rights and obligations of the authorized party as well as of the government in the case of concession agreements. The authorization process is the means of introducing and encouraging competition in the sector.

The kind of licence or authorization used often depends on whether a country has adopted a more traditional regulatory approach, in which individual licences are issued especially for "major" services, or a more "light touch" regime which may use class licences. Some services may also be "licence exempt" in which case they may still be subject to general regulation applicable across the sector.

In some cases, provisions to ensure ICT accessibility may be included in licence conditions and effected as part of the enforcement of an entity's obligations. This works well in the case of public access requirements, where the provision of payphones or community ICT centres may be an operator-specific licence condition (for example, where the service was offered as part of a licensing process) and thus it makes sense to stipulate the conditions associated with the obligation in the operator's licence.

Licence conditions are not amended as frequently as some of the other regulatory instruments, such as regulations, and as such may not be generally appropriate for ICT accessibility requirements in a fast changing ICT sector where technological innovation and developments may improve methods of achieving ICT accessibility. In addition, since licence conditions may vary between players, there is a risk that there will not be a uniform approach. To the extent that compliance with regulations is a condition of licence, it opens the option to use regulations, thus, over time, ensuring a more transparent and level playing field for all operators.

c. Background on regulations

Many of the original service-specific and detailed licence conditions were issued in the early days of regulation; when there was a very limited body of regulation and therefore licence conditions were used as the primary regulatory instrument. Regulators have since promulgated and updated a substantial body of regulations, eliminating the need to issue particular, detailed and specific authorizations. Instead, regulators can simply refer to the relevant regulations where necessary[7].

This approach enables regulators to apply similar sets of requirements on similar types of players in the ICT sector. This is beneficial when it comes to ICT accessibility regulation as it enables the NRA to put in place rules that apply broadly across the sector, and thus enables the implementation of consistent standards and requirements and thus a coordinated approach. Regulations are made following a consultative process in which all relevant stakeholders have an opportunity to make input. They are more easily amended than licence conditions; however in order to ensure stability, regulations are not amended too frequently.

d. Voluntary industry measures

In some instances, voluntary industry measures are particularly effective in promoting equitable access to ICT in a fast changing technology environment. They are also valuable in an environment with a detailed value chain with many players over which the regulator does not have total control. For example, NRAs have little or no control over the manufacturers of devices, however, operators through their procurement decisions can influence the behaviour of manufacturers. As such, it may be more effective for them to put in place voluntary measures to promote ICT accessibility.

---

6 www.ictregulationtoolkit.org/1.3.1 – ICT Regulation Toolkit.

7 Idem.

One of the key steps that policy-makers can take is to ensure that existing accessibility solutions available commercially in the global marketplace are available to persons with disabilities on a national level. For instance, mobile handset vendors offer a variety of handsets with accessible features that can be procured by mobile operators. Similarly, TV set vendors offer embedded solutions for closed captioning. Industry can develop codes of conduct committing to include such existing commercially available solutions in their offerings to consumers. Accessible ICT legislation can encourage the development of such codes of conduct which can be enforced through co-regulation.

Voluntary measures can be supported by regulation, i.e. co-regulatory mechanisms, which can include legislation that[8]:

- delegates the power to a government sponsored committee including industry and representatives of persons with disabilities to develop, monitor and enforce codes;
- enforces undertakings to comply with a code;
- does not require a code but has a reserve power to make a code mandatory;
- requires industry to develop a code negotiated with organizations of persons with disabilities and stipulates that, in its absence, government or the NRA will impose a code or regulation;
- prescribes a code that only applies to those who subscribe to it "prescribed voluntary codes"; or
- prescribes a code as a regulation applying to all industry members "prescribed mandatory codes".

Voluntary measures can include the adoption of guidelines, features, standards when available, negotiated roadmaps and industry codes of conduct and compliance. The model code of conduct in Module 3 (Annex A) is one such example.

Voluntary measures can, however, only be considered in countries that have a regulatory and legal framework that supports such an approach. In such countries, the legislation provides an added layer of assurance that the voluntary measures will achieve ICT accessibility. In many such countries, however, these voluntary measures do not currently provide for the recognition and involvement of organizations of persons with disabilities in public consultations regarding the adoption of standards or selection of commercially available solutions and their effective implementation.

Voluntary industry measures policy recommendation: Countries where the legal framework allows voluntary industry or co-regulation can amend their legal frameworks to recognize the role of organizations of persons with disabilities in the development of voluntary or co-regulation processes.

d. Traditional regulation for ICT accessibility

In many countries ICT legislation does not provide for self-regulatory or co-regulatory regimes which would be enforced through "Industry Codes" or "Codes of Conduct". The law furthermore does not provide for the recognition of industry associations or bodies including organizations of persons with disabilities.

Traditional regulation policy recommendation: As a long term approach, countries where ICT legislation does not provide for co- or self-regulatory approaches can revise their ICT legislation to authorize such "light touch" regulatory regimes and recognize the role of industry associations or bodies and organizations of persons with disabilities in co-regulatory processes. However, in the short term, more traditional regulation – setting out requirements through regulations or licence conditions – preceded by consultative processes is the best option available in such countries. To facilitate implementation of ICT accessibility measures in such countries, among others, a model public access guidelines (see Module 2) and a model mobile communications accessibility policy (see Module 3) are provided in this report.

---

[8] Australian Communications and Media Authority, ***Optimal Conditions for Effective Self- and Co-regulatory Arrangements*** (2010), www.acma.gov.au/theACMA/About/The-ACMA-story/Connected-regulation/optimal-conditions-for-effective-self-and-coregulatory-arrangements

2. Technology and standards

Technical standards ensure interoperability, for example for TV closed captioning, hearing aid compatibility or web accessibility for screen readers. Technical standards are also important for normative purposes such as for defining accessible ICT equipment for public procurement, or for establishing metrics for measuring quality of service for television/video programming and telephony and captioning reliability and synchronization.

Technical standards policy recommendations

In light of the role of standards in ensuring accessibility and in line with Article 9.2(a) of the Convention, governments are required to establish accessibility standards. Article 4(g) states that they must "promote the availability and use of new technologies, including information and communications technologies, mobility aids, devices and assistive technologies, suitable for persons with disabilities, giving priority to technologies at an affordable cost." Thus governments should promote ICT accessibility standards, and adopt international standards to the greatest possible extent to achieve economies of scale to lower cost and ensure interoperability at the same time. Governments should also promote the mainstreaming of accessibility into standards development, including the use of the design guidance in ITU-T Recommendations F.790 and F.703[9].

National regulatory authorities, working with relevant standards bodies, can therefore adopt technical standards, including relevant international standards, to ensure interoperability for a range of ICT products and services such as TV closed captioning and audio description, hearing aid compatibility with mobile telephony, and website compatibility with screen readers. They can also establish quality of service standards for telephony, television/video programming and multimedia services. Likewise, regulators can establish quality of service standards in broadcasting and converged services for closed captioning and audio description accuracy and synchronization. Governments can further provide policy guidance to national standards organizations; or mandate them to set specific standards, adopt international standards, or to align with specifications from international standards organizations.

3. Review of definitions in existing ICTs[10]

Definitions play a fundamental role in legal discourse, they avoid ambiguity in interpretation and they warrant the application of a law to a specific case. Definitions in law can influence every premise of a regulation or code made in terms of that law:

- **Recommendations on review of existing ICT legislation definitions**: Definitions should take into account the objective of facilitating the equal treatment of persons with disabilities and this objective should be explicitly included in primary ICT legislation. NRAs should review existing key definitions and add or amend them as appropriate. In some cases the inclusion of definitions is recommended (only if they are used in the law), in others the definitions already exist and need to be reviewed and aligned. Recommendations on amendments to universal access/service definitions, for example, are provided in Box 4.
- **Recommendations on new ICT legislation definitions to promote ICT accessibility**: In addition to amending existing ICT law definitions, it is necessary to include additional definitions to promote accessibility. The definitions set out here should be included in the ICT law. They apply to all modules in the report. Additional definitions are provided in modules where relevant.

---

[9] The international standard ITU-T in Recommendation F.790 contains guidance on writing accessible standards that can be used by all standards developers while ITU-T F.703 is the international standard for Total Communication, a concept that communication should use *all* possible communication means, depending on the specific needs of users. ITU-T F.790 is complemented by the *accessibility checklist* in Technical Paper ITU-T FSTP-TACL "Telecommunications Accessibility Checklist" (2006).

[10] Some countries use the term “information and communication technology (ICT)” while others use "electronic communications" or "telecommunications" and "broadcasting". The abbreviated form “ICT” or “ICTs” is used in this report.

Box 1: Definitions to be included in ICT legislation

The definitions set out in this box are not currently in most ICT laws, and would need to be included in order to support the new provisions of the law proposed in this and other modules. Legislators and policy-makers are encouraged to confirm whether and where these terms are used before including them in their laws.

"**Accessible communication**" as defined in Article 2 of the Convention on the Rights of Persons with Disabilities, includes any means and formats of communication, whether delivered aurally, visually or tactilely, including spoken and sign language, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communication technology.

"**Accessible publication formats**" means information available in formats such as Braille, audiotape, oral presentation, sign language (included in light of rich media being used in electronic publishing) or electronically for persons with reading impairments.

"**Accessible publishing**" means making information available in an accessible format, which may include, but is not limited to, alternate formats such as Braille, audiotape, oral presentation or electronically for individuals with reading impairments.

"**Assistive technology**" or "**AT**" is any information and communications technology, product, device, equipment and related service used to maintain, increase, or improve the functional capabilities of individuals with specific needs or disabilities.

"**Auxiliary aids and services**" means aids and services that assist persons with disabilities to perceive and understand communications[11]. Auxiliary aids and services can include:

(1) Qualified sign language interpreter services; note takers; computer aided transcription services; written materials or exchange of written notes; telephone amplifiers; assistive listening devices and systems; telephones compatible with hearing aids and cochlear implants; closed caption decoders; open and closed captioning; voice, text and video-based telecommunication products and systems, including videophones and captioned telephones, or equally effective telecommunication devices; videotext displays; accessible electronic and information technology; or other effective methods of making aurally delivered information available to individuals who are deaf or hard of hearing;

(2) Qualified readers; taped texts; audio recordings; Braille materials and displays; screen reader software; magnification software; optical readers; secondary auditory programmes (SAP); large print materials; accessible electronic and information technology; or other effective methods of making visually delivered materials available to individuals who are blind or have low vision;

(3) Acquisition or modification of equipment or devices; and

(4) Other similar services and actions.

"**Braille**" is a series of raised dots that can be read with the fingers by people who are blind or whose eyesight is not sufficient for reading printed material.

"**Committee on ICT accessibility**" means a committee established by the NRA to promote the interests of users, and to ensure the involvement of organizations of persons with disabilities alongside other relevant stakeholders such as representatives of ICT service providers, ICT vendors, and assistive technologies experts including hearing aid and rehabilitation professionals in the development of all policies, regulations or industry codes from the outset. Such committees may form sub-committees for specific areas such as technology and services (TV, mobile telephony, etc.). See Box 3.

"**Effective communication**" means any communication presented in a manner, or for which auxiliary aids are afforded, so that the information provided is equally accessible to individuals with disabilities, including those with visual, hearing, cognitive, learning, speech or motor disabilities. Persons with disabilities shall be consulted whenever possible to determine what type of auxiliary aid is needed to ensure effective communication.

"**ICT accessibility**" is a measure of the extent to which a product or service can be used by a person with a disability as effectively as it can be used by a person without that disability for purposes of accessing or using ICT related products, content or services. ICT accessibility should be achieved to the greatest possible extent by applying Universal Design principles and by ensuring compatibility with assistive technologies.

"**Language**" (Article 2, Convention on the Rights of Persons with Disabilities) includes spoken and signed languages and other forms of non-spoken languages.

"**Persons with disabilities**" (Article 1, Convention on the Rights of Persons with Disabilities) means individuals who have long-term physical, mental, intellectual or sensory impairments, which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others. Older persons with functional disabilities are also regarded as persons with disabilities. In some countries, such as the United States, disability policy does not distinguish between people with temporary or long term disabilities and a country will decide how it wishes to define persons with disabilities (see www.infinitec.org/live/citizenship/adadefine.htm).

"**Relay services**" are phone services operated by interpreters that enable people who are deaf or hard of hearing or who have a speech impairment, to communicate by phone through an interpreter with a person who can hear in a manner that is "functionally equivalent" to the ability of an individual without a disability[12].

"**Universal design**" means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Universal design shall not exclude assistive devices for particular groups of persons with disabilities where this is needed[13].

4. Promoting participation by persons with disabilities in policy-making – Recommendations

Regulation and policy-making processes involve a number of stages prior to the publication of draft or final regulations and policies. As such, it is critical that legislation provides for participation of persons with disabilities and disability organizations and other relevant stakeholders[14] from the outset of all policy reviews, policy-making and/or rule making processes. This includes facilitating participation and consultation in both specific ICT accessibility policies and in policies that impact ICT accessibility such as tariff and licensing policies. Involving persons with disabilities in the consultation process can be done by taking three steps:

1. using effective communication and publishing all documents in accessible format (section 4);
2. ensuring that the public consultation stage includes persons with disabilities (section 4); and

[11] As defined by U.S. Department of Justice regulations implementing Title III of the Americans with Disabilities Act for Titles III, for places of public accommodation, 28 C.F.R. 36.303(b), available at: www.ada.gov/reg3a.html#Anchor-97857.

[12] Definition sourced and adapted from the National Association of the Deaf (United States); see www.nad.org/issues/telephone-and-relay-services/relay-services. See ITU-G3ict Making mobile phones and services accessible for persons with disabilities for additional information on relay services: www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf. FCC Fact Sheet on relay services at www.fcc.gov/cgb/consumerfacts/trs.html discusses relay services including text-to-voice relay services, speech-to-speech relay services, captioned relay services, video relay services, and Internet protocol relay services.

[13] As defined in Article 2, Convention on the Rights of Persons with Disabilities.

[14] Other stakeholders may include operators, licensed service providers of video programming, ICT vendors, assistive technology professionals, NGOs and civil society, among others.

3. establishing a formal consultative process with persons with disabilities, for example by consulting with organizations representing persons with disabilities or establishing a committee on ICT accessibility (see Box 3).

As part of the third step, Ministries or regulators may also wish to set up an annual forum on ICT accessibility for persons with disabilities to raise awareness of ICT accessibility issues and to promote innovation and new accessibility solutions commercially available in the global ICT marketplace. Such annual forums could include exhibitions, innovation competitions, seminars, and other activities. Model provisions to provide for these steps are set out in the remainder of this section.

a. Accessible documents for public consultation processes – Recommendations

It is best practice for NRAs to follow a public consultation process before they promulgate any rules, regulations, or policies. Public consultation processes generally consist of publication of documentation for public comment, and the receipt of written and oral submissions at a public hearing. To ensure participation of persons with disabilities, all documents for consultation processes must be published in accessible formats[15].

Box 2: Publishing in an accessible format[16]

References about effective communication and accessible publication

The right to read is a fundamental right for all persons in the Information Age. The ability to seek, receive and impart information and ideas is vital to ensuring that all persons are able to participate productively in the cultural, scientific and economic life of the country. This includes the ability to have access to the policy- and regulation-making process, including processes to develop policies and regulations which may impact the disability community. However, there are several groups of persons who are unable to access materials in printed form due to a physical, sensory or cognitive disability (print impaired persons). These may be persons who are blind or have low vision, persons who are dyslexic, have a cognitive or learning disability or a physical or motor disability which prevents them from holding or turning the pages of a book or document. It is thus imperative that, in order to ensure consultative processes are inclusive, regulators, policy-makers and other stakeholders make sure that all publications are accessible to these individuals. Creators of electronic documents should make an effort to ensure that their documents are created, published, and disseminated in an accessible manner.

b. Invitation to comment on draft documents – Recommendations

The involvement of persons with disabilities in all regulation-making processes is paramount. NRAs should revise their current public consultation rules and regulations so they make specific reference to the inclusion of persons with disabilities and organizations representing persons with disabilities alongside other relevant stakeholders such as representatives of ICT service providers, ICT vendors and Assistive Technologies experts including hearing aid and rehabilitation professionals. They should ensure that organizations representing persons with disabilities are aware of opportunities to participate in public processes and can access any related documentation by using accessible publication formats and effective communications to broaden participation by all segments of society.

c. Representation and participation by persons with disabilities – Recommendations

Persons with disabilities must be represented and consulted in all policy and regulatory processes covering ICT accessibility or ICT services specifically impacting persons with disabilities. This can be done through public institutions such as the ministry and the NRA establishing relationships with bodies representing persons with disabilities and inviting them to participate in regulatory and policy-making processes.

---

[15] See definitions of "accessible publishing" and "effective communication" in Box 1.

[16] Source: e-accessibility Toolkit: www.e-accessibilitytoolkit.org/toolkit/technology_areas/access_to_published_works

In order to mainstream ICT accessibility, the NRA may set up a committee on ICT accessibility to promote the interests of users and to ensure the involvement of organizations of persons with disabilities in the development of all policies, regulations or industry codes. Such a committee could provide guidance, not only on disability specific policy and regulations, but on all policy and regulations which may impact on persons with disabilities. This may range from tariff regulations (which should take into account special and/or discounted tariffs for certain categories of users, see Module 3, section 7) to licence conditions (for example, licence conditions on accessible public access, see Module 2, Annex A), to advising on accessibility standards[17]. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject to public consultation that includes persons with disabilities.

The establishment of a committee to promote ICT accessibility is fully in line with the mandate of most NRAs, which includes:

- promoting the universal provision of ICT networks and services and connectivity for all;
- protecting consumers;
- promoting fair competition within the sector;
- encouraging investment and innovation in the sector;
- ensuring that users derive maximum benefit in terms of choice, price and quality;
- promoting standardization to ensure interoperability or to ensure that the means of access is predictable and similar across all platforms; and
- promoting international harmonization of standards.

The committee that is established may be a standing committee in countries where the legislation provides for this, or an advisory committee where there is no provision for the establishment of a formal standing committee. Regardless of its form, the committee, where established, should include representatives of disability organizations and representatives of service providers, ICT vendors, and assistive technologies professionals such as hearing aid and rehabilitation experts. Sub-committees may be established for each main area of ICTs in countries where the size and complexity of each sector requires greater focus and the involvement of specific stakeholders (licensed service providers of video programming, mobile service providers, etc.). Alternatively it can be prescribed by law and include representatives of national disability organizations, NGOs, operators and government departments with responsibility for monitoring the achievement of accessibility targets.

Box 3: Model text – Committee on ICT accessibility

Establishing a committee on ICT accessibility

(1) The [NRA/Ministry] must establish a [standing/ad hoc] advisory committee on ICT accessibility (hereinafter the Committee) that will advise the NRA on matters relating to the needs of persons with disabilities in the country.

(2) The constitution of the Committee must be as prescribed and include representatives of disability organizations, service providers, ICT vendors, assistive technologies professionals and other relevant accessibility experts such as hearing aid and rehabilitation professionals.

(3) The Committee must, among other things:

(a) provide comments on proposed policy revisions wherever proposed policy revisions affect ICT accessibility for persons with disabilities, this includes universal service obligations, licence conditions, and tariff regulations, amongst others;

[17] The establishment of a committee on ICT for persons with disabilities may be particularly useful in countries where the organizations representing persons with disabilities are not active in the ICT policy and regulatory space, and where they may not have the expertise or resources to respond to draft documents or participate in consultative processes.

(b) identify services and products provided by ICT service providers and manufacturers that are relevant to the needs of all users and assist the NRA in maintaining an on-going dialogue with those providers;

(c) ensure that internationally available accessible ICT products and international accessibility standards are promoted in the country;

(d) identify accessibility issues for persons with disabilities in relation to ICT products and services;

(e) promote good practice by ICT service providers in relation to the accessibility of customer service;

(f) promote the needs of users through a review of the effectiveness of existing ICT policy, legislation and regulations in meeting the needs of users and recommending improvements and/or new legal instruments; and

(g) promote the integration of persons with disabilities into decision- and policy-making processes affecting ICT accessibility.

(4) Sub-committees by key areas of ICT services may be formed to facilitate a greater focus on specific accessibility challenges and solutions (e.g. television/video programming, mobile telephony etc.).

(5) The [NRA/Ministry] must support the work of persons with disabilities who are members of the Committee, which includes covering the costs of meetings and travel logistics, providing compensation for expert advice when required and ensuring that members are adequately supported through the provision of auxiliary aids and information in accessible formats to fulfil their mandate.

5. Universal access and service (UAS) framework

Most countries include universal access and service as one of the main objectives of their ICT policy and legislation, and this is reflected in the mandate of the NRA. Universal service and access policy frameworks were generally built on two key principles – increasing penetration by expanding network deployment to underserved communities and promoting affordability. While these basic principles remain valid, they are not sufficient to ensure ICT accessibility because persons with disabilities need barrier-free ICT devices and services to access communications on an equal basis with other citizens. To ensure that the large numbers of persons with disabilities and elderly populations are included in universal service goals, a number of policy steps are required related to expanding goals, definitions and the kinds of subsidies to be provided or projects to be funded.

a. UAS definitions – Recommendations

In addition to new definitions being added to ICT legislation, existing definitions may need to be modified to be more inclusive and to consider ICT accessibility holistically. The terms "universal service" and "universal access" should be defined in the law and relevant regulations or licence conditions, and must be aligned with national legislation and powers given to the ministry, NRA, or fund, to not only focus on infrastructure access and affordability but also include provisions relating to ICT accessibility for end users, including persons with disabilities. Likewise, the definition of "underserved community" should be amended such that persons with disabilities are specifically included amongst the beneficiaries.

Box 4: Amending universal service definitions

Defining key universal service terms

"Underserved community" means the population groups identified by the [universal service and access fund/NRA/Ministry] from time to time, which may include persons with disabilities, the elderly, women and/or the poor.

"Universal access" means shared ICT usage and encompasses the near-ubiquitous availability, affordability and accessibility of ICT infrastructure, services and content to all communities and end-users through public access points in schools, libraries, clinics and the like.

"Universal icons" means language neutral signs and symbols usable by all people, to the greatest extent possible, without the need for adaptation or translation.

"Universal service" means individual or personal ICT access and usage and requires the near-ubiquitous provision of affordable, accessible ICT infrastructure, services and content to individuals, households and businesses, including those in underserved areas and forming part of underserved communities.

"Universal service obligation" means a requirement imposed on a licensee to provide ICT infrastructure, services and/or content, including accessible ICT products and services for persons with disabilities, to meet national universal service and universal access objectives.

"Users" means individuals who are consumers of ICT services, including persons with disabilities.

b. Scope and use of universal service and access funds - Recommendations

Many countries have established independent universal service agencies and universal service and access funds (USAFs) through legislation which was drafted mainly to promote network rollout in underserved areas and promote affordable ICT services. These laws must be modified to address the promotion of ICT accessibility for persons with disabilities. The following modifications are necessary to enable countries to use their universal service/access funds to promote ICT accessibility:

- If there is separate legislation establishing a universal service and access fund, it should include appropriate universal service and access-related definitions (see Box 4).
- It may be necessary to put in place a process to enrol[18] persons with disabilities for the purposes of managing any programmes, grants or funds that may be made available to eligible persons with disabilities.
- ICT accessibility should be included as a criterion to assess gaps in services in addition to the existing concepts of penetration/ network coverage and affordability[19].

Where a country has a converged universal and access fund responsible for both telecommunications and broadcasting, the law should be drafted broadly enough to allow for the fund to be used for broadcast related projects such as:

- providing accessible set top boxes to persons with disabilities to facilitate digital migration;
- formal help schemes to switch from analogue to digital television for older persons (who may have difficulties such as bending down to adjust televisions) and those with disabilities; and
- making television/video programming accessible that are not otherwise required in terms of the ICT law and/or policy to be made accessible, while respecting prevailing intellectual property laws.

In the case of USAFs with a telecommunications-specific mandate, the law should be drafted broadly enough or specifically provide that the fund may additionally be used for:

- subsidizing accessible handsets and/or monthly subscriptions;
- subsidizing the provision of relay services;
- subsidizing the purchase of accessible and assistive technology tools by service providers including telecentres and other public access providers, disability organizations or end-users with disabilities:

[18] Certain countries allow individuals to apply directly for grants and subsidies, thus making it easier to "enrol" them as beneficiaries and to provide these individual end users with grants and subsidies. This requires additional institutional and administrative strength on the part of the USAF to be able to address individual applications for subsidies.

[19] http://trace.wisc.edu/docs/framework/framewrk.htm

- funding the customization of basic assistive technologies tools, for example in local languages including text-to-speech, voice recognition, captioning applications and screen readers[20];
- providing incentives for research and development of assistive solutions, such as development of speech-to-text engines in the official languages;
- facilitating the awareness and promotion of universally designed mobile goods;
- facilitating the training of persons with disabilities in using accessible ICTs and the training of professionals supporting persons with disabilities in adopting and using ICT[21], including experts from organizations of persons with disabilities or working with persons with disabilities, such as teachers, health workers and vocational counsellors; and
- facilitating the development of curricula and training of information technology professionals on mobile ICT accessibility.

The use of the USAF for extending public ICT access is explored in more detail in Module 2: ICT accessibility framework on public access and the use of the USAF for extending mobile services is explored in more detail in the Module 3: Mobile communications accessibility policy framework. Funding for television/video programming accessibility, including through USAFs, is explored in more detail in Module 4: Television/video programming accessibility framework.

c. Licence terms and conditions or USAF service level agreements (SLAs) – Recommendations

Non-discrimination is an important principle in ICT accessibility policy and regulation. Equal levels of access and quality of service must be provided to persons with disabilities. In countries where USO's are part of a licence obligation required by the regulator, this non-discrimination principle should be stipulated in the licence terms and conditions. The requirement can also be captured in service level agreements or funding agreements between the USAF and its beneficiaries.

6. Quality of service for ICT accessibility – Recommendations

Quality of Service (QoS) regulations are aimed at making sure that services and devices provided to the public meet specified safety and service standards. As a rule service providers must ensure that services are accessible to all sectors of the public and that certain minimum service standards are maintained. Persons with disabilities may have specific quality of service requirements and the following should be considered in developing or amending such QoS standards and regulations such as:

- Persons with disabilities may have a greater reliance on a particular communications service and QoS regulations should recognize the impact of, for example, the non-delivery of text messages for deaf and hard of hearing users who communicate exclusively via text or poor quality relay services for the deaf.
- The impact of bad quality may be more significant for some users than others (for example, the impact of 'snowy' TV screens on partially sighted users or the impact of poor network quality on persons with hearing loss).

To address potential quality of service concerns, quality of service regulations should be required to take into account the specific needs of persons with disabilities, establishing standards to measure quality of service provided to persons with disabilities, including for accessible services such as relay services,

[20] This may be done in coordination with Ministry of Education – an explicit requirement can be included where the Ministry or NRA has powers to include other ministries in this.

[21] This is required by the UN Convention on the Rights of Persons with Disabilities, General Obligations: Article. 4.1(i).

captioning and audio description. These regulations must be made available to and reviewed by the committee on ICT accessibility[22] where established, or through the periodic review of consumer protection regulations. Any such reviews must, include public consultations involving persons with disabilities.

7. Emergency services – Recommendations

Legislators, policy-makers and ICT regulatory authorities should review their emergency services legislation, policies and regulations to ensure that the needs of persons with disabilities are taken into account. This applies to reviewing the needs for ICT services, including the ITU international public telecommunication numbering plan (E164)[23] numbers used for voice services, short codes and any other applicable numbers. This applies to both broadcasting and telecommunications as set out in this section.

With respect to telecommunications, provisions in law and regulation should require that:

- Persons with disabilities should be able to use their everyday communication means (e.g. terminal equipment and services) for reaching emergency services, and should be able to contact emergency services free of charge, whatever the technology or device they use[24].
- It should be mandatory that all public awareness campaigns specifically provide information on how persons with disabilities can contact and use such services. It is the responsibility of the NRA, service providers, emergency call centres, and public bodies with responsibility for emergency services to create awareness about the availability and accessibility of emergency services by persons with disabilities.
- Emergency information made available to the public should also be provided in alternative accessible formats such as text messages on mobile phones.
- Persons with disabilities using ICTs should be able to contact emergency services via ordinary emergency numbers. As emergency numbers may vary across countries as well as across disabilities, the use of the number "112" and/or "911" as the common emergency number is generally encouraged[25].
- Emergency call centres should be able to receive and respond to SMS text messages as well as calls from relay services to permit emergency calling by people with hearing or speech disabilities.

With respect to broadcasting, provisions in law and regulation should require that:

- Public awareness specifically on how persons with disabilities can use emergency services is mandatory and that any public service announcements required to be aired should include such information. It is the responsibility of the NRA, licensed service providers of video programming and public bodies with responsibility for emergency services to create awareness about the availability and accessibility of emergency services by persons with disabilities.
- Emergency information made available to the public should also be provided in formats accessible to persons with disabilities such as sign language and subtitles for the deaf and hard of hearing and audio messages on television/video programming for those with visual disabilities.

---

[22] See Box 1 and 3 and section 4 of this module. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject to public consultation that includes persons with disabilities.

[23] See ITU Recommendation E.164: www.itu.int/rec/T-REC-E.164/en

[24] It is noted that currently in most countries the NRA recognizes that emergency services used over VoIP services, for example Skype, are not reliable and thus are not offered. Where it is not technically feasible for emergency services to be provided generally, then no requirement will be required for addressing the needs of persons with disabilities.

[25] See ITU Recommendation E.161.1: Overall Network Operation, Telephone Service, Service Operation and Human Factors International Operation – www.itu.int/rec/T-REC-E.161.1

- Public communications and announcements that are broadcast in natural disaster situations must be made accessible to persons with disabilities in appropriate forms of communication, thus leveraging mainstream communication channels. Licensed service providers of video programming must ensure that such announcements and alerts are broadcast in relevant formats accessible to all persons with disabilities.

Box 5: Model text – accessible emergency services

Sample text to be included in ICT legislation to ensure that the needs of persons with disabilities are considered when emergency services are addressed is as follows: *

"Service providers must –

(1) in the case of electronic communications services/ telecommunications, unless it is technically infeasible,

(a) make automatic number identity, such as caller line identity and automatic location identity available to emergency centres;

(b) carry communications to emergency centres; and

(c) Make communications available in accessible formats.

(2) in the case of licensed service providers of video programming, make emergency announcements publicly available on all networks and video programmes in accessible formats.

And:

"The NRA must make regulations to ensure access to emergency services via electronic communications, broadcasting networks and the web, where applicable, by the public, including persons with disabilities". **

Notes:

* Both (1) and (2) may be set out in converged legislation. In countries where legislation is not converged (1) applies to the telecommunication law, and (2) applies to the broadcasting law.

** Sample regulations are provided in the mobile accessibility module and an implementation framework is provided in the television/video programming accessibility module.

8. Targets and reporting requirements

NRAs should establish, in consultation with persons with disabilities in line with section 4 above, annual measurable targets to be implemented by all relevant stakeholders[26], issue an annual public report on implementation, and take necessary enforcement action when appropriate.

Sample targets for ICTs include:

- mainstreaming ICT accessibility into standards;
- existing ICT definitions amended and new definitions added to ICT legislation to promote ICT accessibility;
- committee on ICT accessibility established which provides for the participation of persons with disabilities, disability organizations and other relevant stakeholders in policy-making;
- universal access and service framework includes ICT accessibility as a goal;
- quality of service and other regulations take into account the specific needs of persons with disabilities;
- emergency services legal and regulatory framework takes into account the needs of persons with disabilities; and

[26] Including operators, licensed service providers of video programming, ICT vendors, assistive technology professionals, and emergency response services.

- disability legislation updated with the inclusion of ICTs in the definition of accessibility.

In addition, milestones should be set to measure progress in implementing legal, regulatory or codes of conduct, capacity to implement policy (e.g. establishing necessary budgets and training programmes) and progress in availability of accessible ICTs for persons with disabilities), including access to, availability, and affordability of ICTs based on type of disability per technology (public access, mobile telephony, websites, television/video programming).

Access to information about ICT accessibility for the disability community is critical to ensuring that future reviews of accessibility policy measures are effective and that policy interventions are evidence-based. To achieve this, the NRA should determine reporting requirements for notifying the disability community about the accessibility requirements contained in adopted laws and regulations pursuant to such policies. A thorough review should be conducted by NRAs of *all* reporting requirements to ensure that the correct data is collected with respect to accessibility for persons with disabilities, at the right level of detail and at reasonable intervals[27].

9. Changes to disability/disability rights legislation – Recommendations

One of the challenges to including ICT accessibility in the disability discourse, in addition to changes needed in ICT policies, legislation and regulations, is that disability legislation covering accessibility does not always make specific reference to ICT, mobile communication, electronic communications, broadcasting and video programming services or Internet accessibility[28].

Many countries have general application disability rights legislation that is concerned with non-discriminatory access and opportunity throughout society in areas such as procurement, employment and education. However, in many instances disability access legislation does not address many of the ICT related goods and services that are central to modern society given that ICTs have infiltrated nearly all aspects of the way people live, work and play.

Disability access legislation needs to be reviewed and updated to recognize that an increasing proportion of business is conducted online or telephonically and not in "facilities" or "premises". The definitions of terms such as "premises," "facilities", "places of public accommodation" and "commercial facility" should be revised to include goods and services offered through ICTs that may not be "physically" located. Incorporating a definition on accessibility reflecting the language of Article 9 of the Convention will address this.

ICT policy-makers and regulators could recommend these changes to disability access legislation to ensure that other electronic services, such as automated teller machines, electronic transaction and payment devices, public computer terminals and electronic kiosks, including those used for transportation, also become accessible for persons with disabilities.

10. Periodic review

Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

---

[27] Reporting requirements may need to be changed in regulations, depending on whether the ICT law has a specific section on reporting

[28] There is progress in this regard, as indicated in the *2013 UN Convention on the Rights of Persons with Disabilities ICT Accessibility Progress Report*, which indicated that while in 2012 only 31 per cent of ratifying countries had a definition of accessibility including ICTs in their legislation, this rose to 52 per cent in 2013. See also the G3ict report, *Convention on the Rights of Persons with Disabilities 2013 Accessibility Progress Report*, a survey conducted in cooperation with Disabled People's International (DPI): http://g3ict.org/resource_center/CRPD_2013_ICT_Accessibility_Progress.

Module 2: ICT accessibility framework on public access

The purpose of this module is to provide guidance for policy-makers, regulators, operators and entrepreneurs that provide public access services to assist them to ensure that public access communications services and facilities are accessible for persons with disabilities. The Model ICT accessibility framework on public access therefore includes model licence terms, and guidelines and a checklist for providers of public access services. The rationale for this approach is based on the United Nations Convention on the Rights of Persons with Disabilities (hereinafter the Convention), which in its Preamble, states that mainstreaming disability issues in all frameworks is "an integral part of relevant strategies of sustainable development".

The Convention furthermore recognizes the potential of ICTs to enable access and participation by persons with disabilities in all aspects of society. ICTs are used increasingly as the preferred medium of communication and service delivery across all sectors including employment, education, governance and banking.

While individual telephony and Internet subscriptions are on the rise, these communications services are also provided through public phones, 'phone shops' and shared Internet access points equipped with computers, laptops and tablets. Many Internet users in developing countries rely on public access to surf the web. In addition, commercial and public e-services are increasingly being accessed through the Internet by all categories of citizens for a variety of essential services.

Public access is of particular importance in developing countries, especially the least connected countries, where, according to the ITU report Measuring the Information Society 2013[29], voice, Internet and broadband penetration rates trail those in developed countries.

In light of the role of public access in providing services to the general public and specifically to any person who does not have individual access to ICT services, providers of public telephones and public community Internet access points should be encouraged to ensure that phones and computers and the facilities that house them are accessible and available on an equal basis to persons with disabilities, and that they are responsive to their needs.

The Model public access ICT accessibility guidelines apply to all public access to ICTs, both fixed and wireless, provided by service providers and operators. It applies to public access provided on a stand-alone basis (i.e. public payphones) as well as through public access devices placed in kiosks, phone shops, telecentres, multi-purpose community centres and similar ICT facilities. It is important to note that in some countries:

- regulators have jurisdiction over public access to ICTs provided by operators and service providers as a universal service obligation or other licence condition;
- cyberlabs and Internet cafés are still required to be licensed - although trends are to move away from this – and in such cases, regulators have legal authority to impose regulations, guidelines or other measures on public access[30];and
- in instances where cyberlabs, Internet cafés, telecentres, multipurpose community centres and other forms of public access are established using public funding, for example from the universal service and access fund (USAF), the guidelines can be imposed as part of the service level agreement or contract between the fund and the public access provider.

It is noted that in cases where public access is provided by unlicensed entrepreneurs and small business owners, the regulator cannot enforce any obligations on the public access provider. However the national regulatory authority is encouraged to publish accessibility guidelines that will act as recommendations for commercially-operated public access centres.

---

[29] www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2013/MIS2013_without_Annex_4.pdf.

[30] See Annex A of this module.

The model public access guidelines may be published as guidance for those involved in the provision of public access communication services. If required, regulatory authorities may make these guidelines part of their licence conditions or regulations as appropriate.

This module also includes a set of model licence conditions and sets out model provisions to be included either in licence obligations or regulations on ICT accessibility for persons with disabilities that can be used in cases where public access is provided for in a licence condition or as a universal service obligation. The model licence conditions/universal service obligations on public ICT accessibility for persons with disabilities in Annex A can be adapted for use by the USAF where it funds public access.

Finally, Annex B presents a checklist on accessible public access that can be used as a reporting tool for licensees; alternatively, it can be used by all providers of public access communications services, whether they are regulated or not, to assist them in ensuring that their facilities are accessible.

Model public access ICT accessibility guidelines[31]

[The public access ICT accessibility guidelines apply to all public access to ICT, provided by service providers and operators. "Public access" or "public access communications services" refers to ICT services provided to the public, including persons with disabilities, on a stand-alone basis through public payphones or on a shared basis through devices placed in public spaces such as cyberlabs, Internet cafés, telecentres, multipurpose community centres, kiosks, public community Internet access points and phone shops. Specifically, these guidelines address:

- *operators and service providers that provide public access as a universal service obligation or other licence condition;*
- *providers of public access communication services that receive funding from the USAF or other public funding body to provide public access communications services; and*
- *licensed Internet cafés and cyber labs (in exceptional cases, in countries where licensing is still required).]*

1. National mandate

1.1 [Country] is a signatory to the United Nations Convention on the Rights of Persons with Disabilities ("the Convention" or "CRPD"), which came into force in May 2008. The Convention recognizes accessibility as a condition for persons with disabilities to exercise their rights and fundamental freedoms and requires signatories to adopt appropriate measures for ensuring that persons with disabilities have access to information and communication technology, emergency services and Internet services on an equal basis with others.

1.2 [Country] constitution supports the right to equality before the law. This includes the full and equal enjoyment of all human rights and freedoms by all people. To promote the achievement of equality, legislative and other measures designed to protect or advance persons or categories of persons who historically have been disadvantaged by unfair discrimination on the basis of their disability are required to redress such disadvantage.

1.3 At a national level, a number of policy and legislative instruments contain key provisions that support the stated goal of this policy, i.e. to make ICT accessible for persons with disabilities. These include:

- [Persons with disabilities policy/legislation, citation, brief description]
- [Anti-discrimination policy/legislation, citation, brief description]
- [Procurement policy/legislation, citation, brief description]
- [Access to Information policy/legislation, citation, brief description]
- [Universal Service and Access policy, citation, brief description]
- [Consumer Protection policy/legislation, citation, brief description]
- [Other policy/legislation, citation, brief description]

2. Objectives

2.1 The objective of these Guidelines is to provide an enabling framework to support the development of a culture and practice of ICT accessibility, in particular accessible public access, through:

[31] If required, [*the NRA*] may make such guidelines into licence conditions or regulations as appropriate. See Module 1, section 1 - Options for regulation - for more information. In particular, this may be the case where public access forms part of a licensee universal service obligations. Model licence conditions are provided in Annex A. These Guidelines may also be made into contract terms for persons providing USAF funded public access. The model licence conditions provided in Annex A can be used as a basis for developing such terms and conditions.

- setting out the general principles applicable to ICT accessibility;
- putting in place measures to ensure that persons with disabilities have access, on an equal basis with others, to public ICT devices, services, applications and content in urban, suburban, and rural areas;
- promoting, at an early stage of design and implementation, the accessibility of public ICT services in order to lower costs of providing accessible public ICT services ;
- promoting affordability of public ICT services through subsidies and incentives, where possible; and
- identifying and mitigating the barriers to fully accessible public ICT access services.

2.2 Recognizing the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms, the following principles, must be adhered to and underpin these Guidelines:

- awareness;
- non-discrimination;
- full and effective participation and inclusion in society;
- equality of opportunity;
- accessibility; and
- affordability.

2.3 The steps to achieve these objectives include:

- setting out general principles of ICT accessibility in key policy and legislative provisions related to the provision of public ICT facilities;
- consulting with persons with disabilities in the policy-making process;
- making persons with disabilities and organizations of persons with disabilities aware of accessible public ICT access policies, facilities and services;
- adhering to accessible public procurement procedures, highlighted in Module 6: Accessible ICT public procurement policy framework, to ensure that ICT equipment and services procured for public access facilities are accessible including:
    - upgrading existing ICTs in public facilities, such as public payphones, kiosks and telecentres, to ensure that a reasonable percentage of ICT devices and services are accessible to persons with different kinds of disabilities;
    - ensuring that all new ICT devices and services procured for public facilities, such as public payphones, kiosks and telecentres, and the facilities in which they are housed are accessible for persons with different kinds of disabilities;
- using universal service and access funds to fund the procurement of assistive technologies and to train staff on its use;
- promoting awareness of accessible public access facilities among persons with disabilities, including use of appropriate signage advertising accessible public access facilities;
- training staff how to serve customers with disabilities, including on available accessible ICTs
- ensuring that emergency communications provided in public access facilities are accessible for persons with disabilities; and

- setting measurable targets, reporting annually on their implementation and ensuring enforcement of accessibility provisions as appropriate.

3. Awareness

3.1 Promoting awareness of these Guidelines and the rights of persons with disabilities in the ICT sector is the responsibility of the [NRA/Ministry].

3.2 Public awareness on how persons with disabilities can use public access facilities is the responsibility of the [NRA/Ministry] and the relevant operators and service providers. The information that is made available to the public should be provided in accessible formats with the input and involvement of persons with disabilities and their organizational representatives.

3.3 Providers of public access communications services should:

3.3.1 Ensure that appropriate signage, including the use of universal icons as appropriate, is provided in the immediate vicinity of installed payphones, payphone kiosks or community Internet access points communicating that they are accessible.

3.3.2 Train staff how to serve customers with disabilities and to be knowledgeable on all available accessible ICT features for people with different kinds of disabilities including physical setup and use with assistive technologies

4. Provision of public access communications services

4.1 Non discrimination

4.1.1 Providers of public access communications services have a duty to avoid discriminating, even inadvertently, against persons with disabilities due to a lack of accessibility of their facilities, products and services. This can be achieved by applying universal design principles to their organization, by running accessible outreach programmes and advertisements about available services and equipment options for persons with disabilities and by ensuring that accessibility is systematically ensured in public access locations, services and product offerings from inception.

4.2 Availability of accessible premises, equipment and software

4.2.2 Stand-alone public access devices should be accessible to people with various types of blindness and visual impairments, those who are deaf or hard-of-hearing and those with mobility disabilities.

4.2.2 Public access phones whether stand-alone or in a public space, must be accessible. Accessible public access communication service devices shall include:

(a) hearing aid compatibility;

(b) volume control;

(c) tactile keys for phones with keypads

(d) gesture-based screen readers for touchscreen devices;

(e) wheelchair accessibility[32]; and

(f) use of relay services such as video relay, text relay and speech-to-speech relay when remote interaction with an operator is required.

4.2.3 Public access computers and other devices that have screen access should:

[32] Providers of public access should put in place a reasonable percentage of public phone counters that must be lowered to be accessible to people using wheel chairs. A reasonable starting point is [10% achieved within a period of 2 years].

(a) make use of universal icons;

(b) be equipped with have screen reading software for blind users, where applicable;

(c) be equipped with an audio jack or audio device and be located in a private area if the information accessed needs to be confidential, such as in financial and voting transactions;

(d) be equipped with software that allows for visually impaired users to be able to increase font size and icon sizes;

(e) be equipped with voice synthesizing functionality to convert text to voice where such technology is available in the national or local language;

(f) allow for the use of alternative accessible input/output devices such as joysticks, switches or eye tracking using an integrated or attached camera;

(g) be accessible by wheelchair[33]; and

(h) have Braille readers and Braille printers attached to [a reasonable percentage] of computers in line with demand.

4.2.4 Many of the goals in 2.1 and 2.2 above can be achieved by adherence to the accessible public procurement procedures (highlighted in Module 6: Accessible ICT public procurement policy framework, of this report), which recognize the principle that all ICT procurement funded by government resources should include accessibility requirements.

4.2.5 Subject to the rules governing the [USAF], the [USAF] may be used to fund:

(a) the purchase and installation of separate computers upgraded with assistive technology software for persons with disabilities;

(b) the purchase and installation of assistive hardware and software such as screen magnifiers, joystick mice, and equipment to have eye movements replicate mouse actions;

(c) the training of public access provider staff on disability devices, software and customer care; and

(d) compliance by public access providers with provisions of goals set out in 2.1, 2.2 and 2.3 above.

4.2.6 Where additional features are required to make an existing public phone, publicly accessible computer, community access point or the facility in which it is housed accessible, the service provider should install accessible phones and/or computers in all communities at a ratio of [one accessible pay phone or computer for every five generic pay phones and/or computers], or at least [one accessible pay phone or computer where fewer than five phones and computers are present][34]. All new public phones, publicly accessible computers, community access points and facilities in which they are housed should be accessible.

5. Physical environment accessibility

5.1 All buildings providing public access communication services, including public phone services, community Internet access kiosks and other publicly available ICT services and devices should be accessible. Where feasible, access ramps must be built to enable access to existing buildings hosting such services and elevators should be in place where facilities are not located on ground level:

---

[33] Idem.

[34] This ratio should be adjusted to reflect, at a minimum, twice the ratio of persons with disabilities in the country, i.e. 10 per cent of persons with disabilities would be one for every five.

(a) all new buildings should comply with these recommendations with immediate effect;

(b) existing buildings should be modified to meet these requirements, to the extent practicable, within [*three*] years.

5.2 The height and reach of accessible devices installed should take into consideration the height of wheelchairs or similar assistive mobility technologies[35] used by persons with physical disabilities.

5.3 Accessible devices should be located in places that provide privacy for customers who use services that require communication to be read out loud, and/or provide an audio jack outlet.

6. Emergency services[36]

6.1 ICT service providers providing traditional wired or wireless public access must provide accessible emergency services.

6.2 Persons with disabilities should be able to use their everyday communication means (e.g. terminal equipment and services) for accessing emergency services, and must be able to contact emergency services free of charge regardless of the technology or device they use[37].

6.3 Public awareness specifically highlighting how persons with disabilities can use emergency services is mandatory and is the responsibility of service providers, emergency call centres and public bodies with responsibility for emergency services[38]. The information that is made available to the public should be provided in accessible publication formats.

6.4 The emergency services provisions set out in section 7 of Module 1: ICT accessibility legal, policy and regulatory framework, which are generally applicable to operators and service providers, are also applicable to public access facilities.

7. Training

7.1 Providers of public access should ensure that employees and volunteers that deal with customers and the public receive sensitivity training at least once every [*two*] years. Such training should include information about the culture, languages, and societal norms of persons with disabilities as well as accessibility principles, solutions and sources of information.

8. Targets and reporting requirements

8.1 NRAs should establish, in consultation with persons with disabilities (in line with section 4 of Module 1), annual measurable targets to be implemented by public ICT access providers, issue an annual public report on implementation and take necessary enforcement action when appropriate. Measureable targets could be aligned with the targets identified in section 6, Annex A of this module.

---

[35] Assistive technologies are not limited to ICT and can also be used to refer to assistive mobility technologies such as wheelchairs. This Model ICT accessibility policy report has defined assistive technologies only in respect to ICT.

[36] In countries where there is a great deal of movement of people across borders to neighbouring countries, this requirement is particularly important and it should be coupled with efforts to harmonize short codes and numbers used to access emergency services across borders. This will ensure that users in the region with disabilities are aware of emergency numbers and short codes without having to make additional effort.

[37] This provision can also be given legal strength through inclusion in the ICT Act, under the emergency services section.

[38] Where applicable and where under the jurisdiction of the NRA or Ministry, or else parallel regulations will need to be made by the responsible authority to ensure that it can be enforced.

8.2 In addition, milestones should be set to measure progress in implementing guidelines and licence conditions, capacity to implement guidelines and licence conditions (e.g. establishing necessary budgets and training programmes) and progress in availability of accessible public ICT access for persons with disabilities.

8.3 Access to information about ICT accessibility for the disability community is critical to ensuring that future reviews of accessibility policy measures are effective and that policy interventions are evidence-based. To achieve this, the NRA should determine reporting requirements for notifying the disability community about the accessibility requirements contained in adopted guidelines and licence conditions pursuant to such policies. A thorough review should be conducted by NRAs of all reporting requirements to ensure that the correct data is collected with respect to accessibility for persons with disabilities, at the right level of detail and at reasonable intervals[39].

8.4 [*The NRA/USAF*] is also encouraged to assess and enforce [*licensees/beneficiaries*] adherence to these Guidelines by actively monitoring the accessibility of public communications services and devices for persons with disabilities through spot checks, trials, and visits to public access facilities and take necessary enforcement action where appropriate.

9. Periodic review

9.1 Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

[39] Reporting requirements may need to be changed in regulations, depending on whether the ICT law has a specific section on reporting.

Annex A: Model licence conditions/universal service obligations on public ICT accessibility for persons with disabilities[40]

[This annex sets out model provisions to be included either in licence obligations or regulations on ICT accessibility for persons with disabilities. The provisions may be included in licences where public access is a requirement, e.g. as a universal service obligation]

1. Definitions

- "Public access" or "Public access communications services" means licensed ICT services provided to the public, including persons with disabilities, on a shared or stand-alone basis and includes services provided through public payphones, or through end-user devices placed in cyberlabs, Internet cafés, telecentres, multipurpose community centres, kiosks and public community Internet access points.

2. Consultation

2.1 The input of organizations representing persons with disabilities must be taken into account in the deployment of these public access service obligations and such organizations must be consulted in implementing these[41].

2.2 [*Licensee*] must consult disability groups about the manner in which it will meet its obligations under this licence, and must meet with such groups on at least an annual basis to advise them on progress regarding implementation of the licence conditions, and relevant services, products and campaigns introduced.

2.3 [*Licensee*] may conduct the consultative processes jointly, including via industry trade associations that represent it, to the extent that no competitive issues or issues prohibited in terms of Competition Law or any other law are discussed in the meetings.

3. Public access devices (shared and stand alone)

3.1 [*Licensee*] must be guided by the Model public access ICT accessibility guidelines in the implementation of its obligations.

3.2 [*Licensee*] must:

(a) Ensure that [*at least 20%]* of their public access devices enable use by persons using hearing aids or cochlear implants, in a manner that does not cause interference with the hearing aids;

(b) Provide [*100%*] of phones with amplification;

(c) Ensure that the operable parts or features of [*10%*] of public access devices are at a height to ensure an accessible reach range for people who use wheelchairs and people of small stature. At every location with more than one public access device, at least one must be accessible for these persons with disabilities;

(d) Ensure that [*20%*] of the public access devices provided at any location, and at least one at any location, are accessible to persons with sensory impairments;

(e) Where necessary, provide an access ramp to facilitate wheelchair access;

---

[40] The specific national context will have to be taken into account. These model licence conditions will be applicable where a licensee is required to provide public access as part of their licence agreement. Where a licensee is required to provide public access in compliance with a funding condition, these model licence conditions can be amended to read as model agreement terms and conditions, and the word "licensee" can be replaced by "beneficiary".

[41] If a country has established a committee on ICT accessibility for persons with disabilities, as recommended in Module 1: ICT accessibility legal, policy and regulatory framework (section 4), then this committee should be explicitly mentioned.

(f) If mobile technology is used, provide for data services including, at a minimum, short messaging services (text);

(g) Provide for proper visible and braille signage; and

(h) Make the public aware of the availability of accessible public access, products and emergency services.

4. Training

4.1 Each licensee shall ensure that all its employees that deal with customers and the public receive sensitivity training on a regular basis, at least once every [*two*] years. Such training should include information about the culture, languages, as relevant and societal norms of persons with disabilities as well as accessibility principles, solutions and sources of information.

5. Emergency services

5.1 The emergency services provisions, which are generally applicable for communications services, must be complied within the provision of public access communications services as provided in the Model public access ICT accessibility guidelines (section 7 of Module 1).

6. Targets

Requirement	Timeframe (Licensee with already existing public access)	Timeframe (New Licensee)
AVAILABILITY OF ACCESSIBLE DEVICES		
Alignment of procurement policies	Within 12 months	Immediate
Accessible public access devices installed and available for use by persons with disabilities in line with section 3, Annex A of this module	Within 12 months	Immediate
AWARENESS		
Public awareness of accessible ICT products and accessible emergency services	Within 6 months	Immediate
Staff trained	Within 12 months	Immediate
EMERGENCY SERVICES		
Accessible emergency services available	Within 6 months	Immediate
Emergency services include ability to send texts and/or video in line with Module 3: Mobile communications accessibility policy framework, section 8	As soon as practically possible	As soon as practically possible

7. Reporting

7.1 In order to ensure compliance with these terms and conditions, [Licensee] must provide an annual report to the NRA which includes, at a minimum:

(a) Information on [Licensee] compliance with these licence conditions; and

(b) A completed checklist, as provided in Annex B of this module, for each of [Licensee] facilities.

Annex B: Checklist on accessible public access facilities[42]

[This annex presents a checklist that can be used as a reporting tool for licensees. It can also be used by all providers of public access communications services, whether regulated or not, to assist them in ensuring that their facilities are accessible.

Compliance with some of the requirements set out in the checklist may be funded by the USAF, provided that the requirement falls within the mandate of a country's USAF. For example, some elements of training and some types of hardware may be eligible for user or operator subsidies[43]*. USAF funding is generally not available in the areas that are blocked out in grey in the table below. If funding has been received from a USAF, the level of funding should be indicated.]*

Requirement/Recommendation[44]	USAF Funding Received[45]	Comments
STRATEGY, PLANNING, POLICIES, AND EVALUATION		
Are people with disabilities included in planning and evaluating public access facility products and services?		
Do you require that accessibility be considered in the procurement process for computer hardware and software? Refer to Module 6 on Public Procurement.		
Do you have a procedure to ensure a timely response to requests for disability-related accommodations?		
PHYSICAL ENVIRONMENTS AND AWARENESS		
Is it easy for public access facility visitors with disabilities to know what accessible ICT and assistive hardware and software are available in the public access facility?		
Are parking areas, pathways, and entrances to the building wheelchair-accessible and clearly marked?		
Are there high-contrast, large-print signs to and throughout the public access facility and braille signage in the public access facility?		
Is at least part of a service counter or desk at a height accessible from a seated position/ accessible to persons in wheelchairs?		
Is an adjustable-height table available for some of the workstations in the public access facility? Can the height be adjusted from a seated position?		
Are aisles wide and clear of obstructions for wheelchair users as well as people with mobility or visual impairments?		
Is equipment accessible by people with sensory impairments, including the deaf and hard-of-hearing and the blind and people with low vision?		
PUBLIC ACCESS FACILITY STAFF TRAINING		

[42] Adapted from University of Washington Computer Lab checklist, see www.washington.edu/doit/Brochures/Academics/comp_lab_check.html

[43] Each country should adapt this checklist to meet its needs and it should be modified to reflect requirements that can be funded by the USAF. Where funding can be applied for, the block should be "white" and where it is not available it should be blocked off in "grey"." Countries without a USAF should delete the column.

[44] In countries where the requirement is set out in a licence condition or in regulations it should be called a "requirement". Where the checklist is being used by providers of public access as a guideline on a voluntary basis, it is a "recommendation".

[45] Boxes not shaded in are eligible for USAF or other public funding. Indicate whether you have received USAF or other public funding.

Requirement/Recommendation[44]	**USAF Funding Received**[45]	**Comments**
Are staff members familiar with the availability and use of accessible ICT features, assistive technology and alternate document formats?		
Have staff members received sensitivity training and training on use of ICTs by persons with disabilities?		
HARDWARE		
Is at least one large monitor available so that a larger amount of screen can be viewed while magnified?		
Is equipment marked with large-print and/or Braille labels?		
Can controls on computers, printers, scanners, and other information technology be reached from a seated position?		
Are adequate work areas available for both right- and left-handed users and is hardware easily useable by both users?		
Do you provide alternate hardware to replace the mouse and/or keyboard (e.g., a trackball, joystick, mini-keyboard, one-handed keyboard)?		
SOFTWARE		
Do you provide special software that is beneficial to persons with disabilities (e.g. screen readers)?		
Do electronic resources, including the public access provider's webpages, adhere to accessibility guidelines or standards in line with Module 5: Model web accessibility policy?		

Module 3: Mobile communications accessibility policy framework

The mobile communications accessibility policy framework module has been developed for policy-makers, regulators and other stakeholders active in information and communication technologies (ICT) and disability issues, including non-governmental organizations (NGOs), organizations of persons with disabilities, and parliamentarians depending on country specifics.

This module provides a framework for countries to put in place a policy that promotes mobile communications accessibility and includes a supporting mobile communications industry code of conduct and regulations, either of which can be used depending on the institutional framework of a given country as explained in Module 1: ICT accessibility legal, policy, and regulatory framework (see section 1, Options for regulation).

This module also provides a Model code of conduct on mobile communications accessibility for persons with disabilities in Annex A and its use is encouraged in countries with a legal framework that supports voluntary industry initiatives or codes of conduct. Where no such regime exists, the model regulations provided in Annex B of this module may be used by the national regulatory authority (NRA)[46].

The Model mobile communications accessibility policy has been prepared pursuant to the United Nations Convention on the Rights of Persons with Disabilities (hereinafter the Convention), and in line with the International Telecommunication Union (ITU) and G3ict ICT Accessibility Policy Toolkit for persons with disabilities (www.e-accessibilitytoolkit.org).

The Convention provides that signatories are responsible for ensuring ICT accessibility; and this model policy and code of conduct are designed to assist signatory countries develop a framework to achieve this. Countries can adopt or adapt these policy and regulatory provisions even if they are not signatories to the Convention.

Success with respect to achieving the goals set out in the Convention relies on the adoption and early implementation of ICT accessibility policies by a country. Each country has to decide on the respective policies and the timing for their implementation in accordance with its unique circumstances.

The Model mobile communications accessibility policy in this module will assist countries to understand the generic steps and requirements and provides guidance on areas where they can be amended to meet national circumstances. The goals of the policy, soft law and regulatory approaches identified in this module are to create a policy, soft law and regulatory framework which promotes ICT accessibility for persons with disabilities by taking the following steps:

- Adoption of a mobile communications accessibility policy, either as a stand-alone document or integrated into an existing policy.
- Consulting with persons with disabilities on the development of a mobile communications accessibility policy.
- The government promoting awareness of the policy and the mobile industry promoting awareness of accessible mobile communications among persons with disabilities and organizations of persons with disabilities, including through use of accessible formats.
- The government conducting a gap analysis on the in-country availability of assistive technology (AT) that can be used with mobile communications, identifying areas for government action to close the AT gap, and implementing appropriate measures such as developing incentive schemes and funding research and development.
- Using universal service and access funds (USAFs) to subsidize the costs of accessible mobile communications and AT for persons with disabilities as well as for teachers, special educators and vocational trainers providing services to persons with disabilities.

[46] See also Module 1: ICT accessibility legal, policy, and regulatory framework, section 1 - options for regulation.

- Mobile operators and retailers ensuring in their sales outlets widespread availability of accessible handsets and other mobile devices embedded with accessibility features for persons with different kinds of disabilities, including by amending their procurement policies to procure for their sale to customers a range of accessible handsets and other mobile devices embedded with accessibility features for persons with different kinds of disabilities.
- Mobile operators and retailers ensuring their sales outlets are accessible for persons with disabilities.
- The mobile industry training its sales staff to serve customers with disabilities and to make customers with disabilities aware of accessible features and product support information.
- The mobile industry providing dedicated customer care facilities, in-store support or staff at call centres who are trained to assist customers with disabilities.
- The mobile industry promoting the development and availability of accessible applications ('apps') for persons with disabilities and accessible 'app stores'.
- Mobile operators ensuring special or discounted rates for persons with disabilities such as text-only plans for the deaf and hard-of-hearing.
- The mobile industry ensuring that emergency mobile communications are accessible for persons with disabilities, including provision of real-time text and video-relay, and making persons with disabilities and organizations of persons with disabilities aware of these accessible emergency mobile communications.
- The government setting measurable targets, reporting annually on their implementation and ensuring enforcement of accessibility provisions as appropriate.

Because of the rapid advances in technological developments, countries are encouraged to adopt processes to conduct periodic reviews of the policy and code or regulations, once passed, to best harness these technological opportunities.

Model mobile communications accessibility policy

1. *Definitions*

1.1 The following definitions are for use in the framework of a mobile communications accessibility policy.

- **"Accessible formats"** means information available in formats such as, but not limited to, Braille, text-to-speech, oral presentation, electronic files compatible with screen readers for persons with reading impairments, captioned or signed video for persons with hearing impairments or icons and animations for persons with cognitive disabilities.
- **"Assistive technology" or "AT"** is any information and communications technology, product, device, equipment and related service used to maintain, increase or improve the functional capabilities of individuals with special needs or disabilities.
- **"Braille"** is a series of raised dots that can be read with the fingers by people who are blind or whose eyesight is not sufficient for reading printed material.
- **"Device" or "Mobile device"** means a handset, smartphone, tablet or any type of customer equipment wirelessly connected via a SIM card issued by a licensed network operator.
- **"ICT accessibility"** is a measure of the extent to which a product or service can be used by a person with a disability as effectively as it can be used by a person without that disability for purposes of accessing or using ICT related products, content or services. ICT accessibility should be achieved to the greatest possible extent by applying universal design principles and by ensuring compatibility with assistive technologies.
- **"Internet service provider" or "ISP"** means a company that offers access to the Internet and to e-mail.
- **"Mobile industry"** includes network operators, service providers, mobile device distributors and retailers[47].
- "**Relay services"**[48] are phone services operated by interpreters that enable people who are deaf or hard of hearing or who have a speech impairment, to communicate by phone through an interpreter with a person who can hear in a manner that is "functionally equivalent" to the ability of an individual without a disability[49].
- **"Text only packages"** means mobile packages which exclude voice services but include data services such as text messaging, instant messaging, picture messaging and web browsing.

---

[47] Handset manufacturers and mobile operating system vendors can be included in the definition of mobile industry if the country has handset manufacturers or operating system vendors established in the country.

[48] Making mobile phones and services accessible for persons with disabilities, ITU and G3ict, 2012 (www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf) for more information on relay services. FCC Fact Sheet on relay services at www.fcc.gov/cgb/consumerfacts/trs.html that discusses types of relay services including text-to-voice relay services, speech-to-speech relay services, captioned relay services, video relay services and Internet protocol relay services.

[49] Definition sourced and adapted from the National Association of the Deaf (United States); see www.nad.org/issues/telephone-and-relay-services/relay-services. Including video relay services, text relay services (TTY), speech-to-speech relay services, captioned speech relay services, and instant messaging relay. For more information see Making mobile phones and services accessible for persons with disabilities report: www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf

- **"Universal design"** means the design of products, environments, programmes and services to be usable by all people to the greatest extent possible, without the need for adaptation or specialized design. Universal design shall not exclude assistive devices for particular groups of persons with disabilities where this is needed[50].
- **"Wireless applications service provider" or "WASP"** means a third party service provider who manages applications and creates and distributes mobile content to mobile users via a licensed mobile operator's network and infrastructure.

2. Effective date and application

2.1 This policy may be cited as the mobile communications accessibility policy and shall come into effect upon publication in the [official government publication[51]].

2.2 The mobile communications accessibility policy applies to the mobile industry and covers:

(a) Mobile services (voice, data, broadband), including emergency and directory services;

(b) Mobile industry customer support services including call centres, customer support centres, web sites, and points of sale; and

(c) End-user devices, including basic phones, feature phones, smartphones, tablets, and assistive applications and services.

2.3 [Insert relevant provision of legislation] provides that [the Ministry[52]] is the body responsible for making national policy to promote universal service and universal access in the ICT sector, including access by persons with disabilities to mobile services, applications and devices.

3. National mandate

3.1 [Country] is a signatory to the United Nations Convention on the Rights of Persons with Disabilities ("the CRPD" or "the Convention"), which came into force in May 2008[53]. The Convention recognizes accessibility as a condition for persons with disabilities to fully enjoy all human rights and fundamental freedoms[54] and requires signatories to adopt appropriate measures for access by

---

[50] As defined in Article 2, UN Convention on the Rights of Persons with Disabilities.

[51] Insert relevant publication name.

[52] The accessibility policy should be developed by the ministry responsible for communications (or in countries without a ministry by the entity responsible for communications), often with significant input or even responsibility for drafting by the regulator. As discussed at www.ictregulationtoolkit.org/en/Section3259.html, the ministry might of course be constituted in one of several ways:

- telecommunications;
- electronic communications (including broadcasting and other media);
- information and communication technology (or communication and information technology);
- infrastructure, including transportation;
- combined with industry or science and technology; or
- combined with another sector such as economic affairs.

[53] This section to be included only if applicable to the country; i.e. if the country is a signatory to the UN Convention on the Rights of Persons with Disabilities.

[54] UN Convention on the Rights of Persons with Disabilities, Preamble, Section (v)

persons with disabilities on an equal basis with others to information and communication technology, emergency services and Internet services[55].

3.2 [Country] constitution supports the right to equality before the law. This includes the full and equal enjoyment of all rights and freedoms. To promote the achievement of equality, legislative and other measures are designed to protect or advance persons or categories of persons, disadvantaged by unfair discrimination. Removing barriers to access to essential services such as mobile communications services is a necessary condition for persons with disabilities to fully enjoy their fundamental rights and freedoms and participate in society on an equal basis with others.

3.3 At a national level, a number of policy and legislative instruments contain key provisions that support the stated goal of this policy: of making ICT accessible for persons with disabilities. These include:

(a) [Persons with disabilities policy/legislation, citation, brief description];

(b) [Anti-discrimination policy/ legislation, citation, brief description];

(c) [Procurement policy/legislation, citation, brief description];

(d) [Access to Information policy/legislation, citation, brief description];

(e) [Universal Service and Access policy, citation, brief description];

(f) [Consumer Protection policy/legislation, citation, brief description];

(g) [Homeland security and national emergency policy/legislation, citation, brief description]; and

(h) [Other policy/legislation, citation, brief description];

3.4 The objective of this policy is to provide an enabling framework to support the development of a culture and practice of ICT accessibility, in particular mobile communications accessibility, through:

(a) Defining the general principles by which mobile communications accessibility is to be treated;

(b) Identifying and mitigating the identified leading barriers to fully accessible mobile communications;

(c) Promoting awareness of accessible mobile communications among persons with disabilities and organizations of persons with disabilities;

(d) Identifying relevant standards, including international standards, and global economies of scale to lower costs and promote interoperability;

---

[55] Outcomes intended by Article 9 of the UN Convention on the Rights of Persons with Disabilities include but are not exclusive to the following:

- The obligation for States Parties to ensure that persons with disabilities have access to information and communication technologies;
- The obligation to ensure that all content, communication, hardware, software and interfaces are to be accessible;
- The promotion of assistive technologies and information in alternative formats to persons with disabilities to ensure their access to information;
- The provision of general information to the public in accessible formats and technologies for persons with disabilities at no extra cost and in a timely fashion;
- The need for private entities offering any kind of facilities and services for the general public to consider the different accessibility needs of persons with disabilities
- The obligation to include emergency services as part of the obligation to provide accessible information and communication services;
- The promotion of the accessibility and usage of mobile communication and services among persons with disabilities, including the Internet, especially in developing countries, considering that ICT services are being accessed through mobile phones, tablets, and other emerging technologies and platforms.

(e) Promoting widespread commercial availability of handsets and other mobile devices with embedded accessibility features[56];

(f) Putting in place measures to ensure that persons with disabilities have equivalent access as those without disabilities to mobile networks, devices, services, applications and content provided to the public in urban, suburban and rural areas;

(g) Promoting the accessible design, development, production and distribution of accessible mobile devices and services, at an early stage of development, so that mobile devices and services are available with accessibility features at a low cost and in a timely manner;

(h) Promoting affordability of accessible mobile devices and services through requirements for non-discrimination, subsidies and incentives, where possible; and

(i) Defining an institutional framework to ensure transparent oversight, and impartial dispute resolution that will strengthen the promotion of mobile communications accessibility.

3.5 Recognizing the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms, the following principles, must be adhered to and underpin this policy:

(a) Non-discrimination;

(b) Full and effective participation and inclusion in society;

(c) Equality of opportunity;

(d) Accessibility;

(e) Affordability; and

(f) Awareness.

3.6 Recognizing that the mobile communications industry has in depth knowledge of its own products, services and strategies, this mobile communications accessibility policy therefore encourages the industry to take measures to promote mobile accessibility. The mobile industry is thus encouraged to develop a [self or co-regulatory] code of conduct on mobile communications accessibility for persons with disabilities. Where no such code of conduct is developed, the [National Regulatory Authority] will make regulations to give effect to this policy[57].

4. Sales, retail outlets, customer care and public awareness

4.1 Awareness of this policy and of the availability of accessible mobile products and services for persons with disabilities is critical to promoting ICT accessibility. The [NRA, universal service and access fund (USAF), and the mobile communications industry] are responsible for spreading awareness of the available accessible mobile products and services for persons with disabilities and the benefits of assistive technologies for persons with disabilities and the rest of society. The information that is made available to the public should be provided in accessible formats upon request and promoted through appropriate channels using effective communications (including captioning, sign language or audio description in video, as needed) to reach persons with disabilities.

---

[56] Although accessible features are embedded in some handsets which are commercially available in the global marketplace, some operators may opt to make available for sale only cheaper handsets with no embedded accessible features due to customer affordability concerns. This policy would not prevent operators from continuing to offer such cheaper, non-accessible handsets, but would ensure that accessible handsets that are commercially available in the global marketplace are part of the operator's sales offering.

[57] See Annex A for guidelines on the code of conduct on mobile communications accessibility for persons with disabilities. The code of conduct may also be drafted as regulations by the NRA – see Annex B for model regulations on mobile communications accessibility. See also Module 1, section 1 on options for regulation.

4.2 Operators should ensure that organizations of persons with disabilities are aware of available accessible mobile products and services by compiling a database of disability organizations representing persons with different disabilities, and sending them information periodically about the accessible mobile services and products offered.

4.3 Awareness of this policy and its related [code of conduct or] [regulations] is the responsibility of the Ministry and NRA respectively. In addition, an annual survey will be conducted by the [Ministry responsible for ICT or NRA depending on country requirements] to assess the levels of national awareness of accessible mobile products, services, devices and initiatives.

4.4 Public awareness on how persons with disabilities can use emergency services provided through mobile phones is the responsibility of public authorities, service providers, emergency call centres[58] and public bodies with the responsibility for emergency services[59]. The parties must cooperate in order to ensure that there is awareness. The information that is made available to the public should be provided in accessible formats with the input and involvement of persons with disabilities and their organizational representatives. The information should be promoted through appropriate channels reaching persons with disabilities.

4.5 Where a person with a disability advises a mobile operator, service provider or manufacturer of his or her disability, the operator, service provider or manufacturer must, at no charge to the consumer and in an appropriate format, make the consumer aware of accessible mobile services, products and features that are available, as well as product support information, in order to assist the consumer in finding, acquiring and using an accessible mobile service, product or feature.

4.6 Mobile operators and service providers must also ensure that customers with disabilities are made aware of and are enabled to purchase services, devices and accessories at company owned or controlled retail shops, call centres, the Internet, and through direct sales by phone. Operators must also make persons with disabilities aware of accessible mobile products and services including through targeted marketing to persons with disabilities using appropriate alternative modes of communication as necessary.

4.7 Mobile operators and service providers must provide dedicated customer care with trained personnel to customers with disabilities including at call centres and designated stores, as well as provide all customer communications in accessible formats.

5. Products, services and devices

5.1 Mobile operators and service providers are required to provide a choice of a range of accessible mobile products, services and devices with varying features, functions and prices meeting the requirements of various types of disabilities.

5.2 [The NRA and the policy-maker] have little influence in terms of the procurement policies of the mobile industry. It is therefore the responsibility of mobile operators, service providers and manufacturers to seek to ensure that the principles of universal design are adhered to in terms of all of the goods and services that they manufacture, procure and provide to the public.

5.3 [The NRA] will conduct and publish an annual national survey on the availability of accessible mobile devices and services for persons with different kinds of disabilities provided by mobile operators and retailers. The annual survey will also address the availability of assistive technologies for use with

[58] Where applicable and where under the jurisdiction of the NRA or Ministry, or else parallel regulations will need to be made by the responsible authority to ensure that it can be enforced.

[59] Where applicable and where under the jurisdiction of the NRA or Ministry, or else parallel regulations will need to be made by the responsible authority to ensure that it can be enforced.

mobile communications in line with section 9 below, as well as awareness by persons with disabilities of this policy and its related [code of conduct or] [regulations] and of available accessible and assistive mobile communications.

5.4 [The NRA] may type approve[60] all devices and equipment that are made available for use by the public. Type approval processes may take into account measures to promote accessibility. Mobile operators, service providers and manufacturers shall not modify type approved goods and services.

5.5 [The NRA] may issue minimum accessibility performance standards[61] for specific categories of goods and services which should be made available in its jurisdiction to users with specific types of disabilities. Such performance standards will specify accessibility requirements to meet the needs of users with physical, cognitive, intellectual or sensory impairments and take into account the market availability of such features, including by referencing databases of accessible mobile devices such as the Mobile Manufacturers Forum (MMF)[62].

5.5.1 Such minimum performance standards should be prescribed by the NRA within [12 months] of the publication of this policy.

5.5.2 Adherence to this list will become mandatory [18 months] from the effective date of the publication of the minimum performance standards.

5.5.3 [The NRA] should review the list periodically in consultation with representatives of the mobile communications industry and organizations of persons with disabilities.

5.6 Training of personnel, in particular those that deal with customers, is an important aspect of the delivery of accessible services. The mobile industry must use trained personnel to promote and support available accessibility options to persons with disabilities and must provide information and customer support to such individuals in the official languages.

6. Applications

6.1 With the growth in the penetration of broadband and the use of smartphones, it is important to promote the accessibility of mobile applications for persons with disabilities[63].

6.2 Mainstream applications developed or preloaded on end-user devices by mobile service providers must be accessible for persons with disabilities.

6.3 Pre-installed assistive technology applications designed to improve access for a specific disability may not need to be accessible to all users with different types of disabilities.

---

[60] Type approval is granted to a product that meets a minimum set of regulatory technical and safety requirements. Generally, type approval is required before a product is allowed to be sold in a particular country, so the requirements for a given product will vary around the world. Compliance to type-approval requirements is often denoted by a marking on the back of the product.

[61] See an example at www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards

[62] The MMF GARI database can be consulted at: www.mobileaccessibility.info/. It is currently made available through the web sites of industry associations, operators and telecom regulators including in the United States and Australia.

[63] [Country] realizes that content and applications are often provided by third parties and that [the NRA] does not regulate the developers or sellers of applications. Therefore, this policy does not seek to set out accessibility obligations for the mobile operators and service providers with respect to the sale and support of applications, including assistive technology software, that operate on devices sold by the mobile operators and service providers, so long as such applications are sold by third parties. This is the case as long as they are outside the control of mobile operators and service providers, and are not pre-installed by such operators and service providers or directed to be installed for the purpose of either enabling the operation of the providers' service or achieving accessibility by persons with disabilities.

6.4 Mobile operators should, to the extent practicable, ensure that wireless applications service providers and Internet service providers that use their networks, have put in place measures to encourage the development of accessible applications, ensure the accessibility of their "app stores" as well as create awareness of the availability of accessible applications[64].

6.5 Mobile service providers must ensure that their own application stores are accessible.

7. Special and/or discounted rates and plans

7.1 In addition to the accessibility and availability of communications products, services and devices, affordability of accessible mobile products and services can also pose a key challenge for persons with disabilities. This includes paying for a full suite of services which they may not be able to use. For example, operators may not offer text only packages that are suitable for deaf users who rely on data and not voice; or mobile operators may levy additional charges for relay services, thus disadvantaging their users.

7.2 To ensure affordability, and to take into consideration the differences in the manner that certain mobile communications services are used by persons with disabilities, mobile operators and service providers should offer special and/or discounted rates and plans, as appropriate, for users with disabilities[65]. These rates and plans must be notified by the operator to the NRA every year and organizations of persons with disabilities and/or the committee on ICT accessibility[66] should be consulted in their design and development[67].

7.3 Mobile operators and service providers must inform the public of their special and/or discounted rate plans and services in all platforms, including outlets, websites, etc., where information with regard to general rates and plans is provided.

7.4 Mobile operators must make the qualification criteria for such special and/or discounted rate plans publically available.

---

[64] In some countries, wireless application service providers and Internet service providers belong to industry associations which have agreements with mobile operators, sometimes as a condition of their commercial agreements with mobile operators, with respect to taking down objectionable or illegal content on notification. These agreements can be expanded to include the need for the wireless application service providers and Internet service providers to address accessibility, and as such can be used as a tool to advance the accessibility of websites and applications made available on mobile phones and networks. This can be reviewed periodically in line with policy, market and technological developments in the mobile applications space.

[65] For example, text-only plans for deaf/hard of hearing, requirements that people using relay services pay no more for their calls than calls made without relay.

[66] In order to mainstream ICT accessibility, the NRA may set up a committee on ICT accessibility in furtherance of its statutory objectives to promote the interests of users, and to ensure the involvement of persons with disabilities, organizations of persons with disabilities, industry and other stakeholders in the development of all policies, regulations or industry codes from the outset. The committee on ICT accessibility will provide guidance, not only on disability policy and regulations, but on all policy and regulations which may impact persons with disabilities. This may range from tariff regulations (which should take into account special and/or discounted tariffs for certain categories of users) to licence conditions (for example licence conditions on accessible public access), to advising on accessibility standards. This is discussed in greater detail in Section 4 of Module 1: ICT accessibility legal, policy, and regulatory framework. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject to public consultation that includes persons with disabilities.

[67] The requirement is for notification to the regulator for information and NOT for approval. Each country must consider its price regulation regime and adapt the requirement appropriately.

8. Emergency services[68]

8.1 Mobile operators and service providers must provide accessible emergency services for persons with disabilities equivalent to those available to persons without disabilities.

8.2 Persons with disabilities should be able to use their everyday communication means, e.g. terminal equipment, mode of communication and services for accessing emergency services, and must be able to contact emergency services free of charge whatever the mobile technology or device they use.

8.3 Within [two years] of the publication of this policy, mobile operators will make available a service that allows deaf or hearing impaired individuals to text with acknowledgment of receipt, via real time text[69] or send video emergency notifications through video relay[70] services to the responsible authority emergency service hotline number in real time, where possible, to enable a speedy response.

8.4 Within [two years] of the publication of this policy, mobile operators should provide emergency agencies with callers' geo-location information[71] and indicate, where geo-location information is available, if the caller is a subscriber who is enrolled as having a disability[72], [73].

8.5 Within [one year] [the NRA] will coordinate with national disaster and emergency preparedness agencies in developing and overseeing emergency communications requirements and with mobile operators to ensure that emergency and public safety alerts are provided in accessible formats to persons with disabilities (e.g. visual alerts for the deaf and vibration alerts for the blind).

8.6 In order for emergency services to be effective, it is critical that persons with disabilities are aware of the emergency services that are available and accessible. Public awareness specifically on how persons with disabilities can use emergency services is mandatory and is the responsibility of the NRA, mobile operators, service providers, emergency call centres[74] and public bodies with responsibility for emergency services[75]. The information that is made available to the public should be provided in accessible formats and also in the official languages, upon request.

8.7 [The NRA] should ensure that these minimum requirements, and any other reasonable requirements to promote accessibility in an emergency situation are included in [Consumer Protection Regulations] or a mobile industry initiated code of conduct within [one year (12 months)].

---

[68] In countries where there is a great deal of movement of people across borders to neighbouring countries, this requirement is particularly important. It should be coupled with efforts to harmonize short codes and numbers used to access emergency services. This will ensure that users with disabilities in the region are aware of emergency numbers and short codes without having to make additional effort.

[69] See Real Time Text Task Force at www.realtimetext.org/ and Reach 112 project at www.reach112.eu/view/en/index.html

[70] See definition of relay services in Box 1, Module 1: ICT accessibility legal, policy and regulatory framework.

[71] Geo-location information can be collected, for example, via handset radio signal or Global Positioning System (GPS) functionalities.

[72] The obligation set out in this paragraph can only apply in countries where it would not contravene privacy laws.

[73] See implementation of emergency geo-information in Poland: https://itunews.itu.int/en/3830-Polands-system-for-locating-emergency-calls-and-facilitating-number-portability.note.aspx

[74] Where applicable and where under the jurisdiction of the NRA or Ministry, or else parallel regulations will need to be made by the responsible authority to ensure that it can be enforced.

[75] Where applicable and where under the jurisdiction of the NRA or Ministry; otherwise parallel regulations will need to be made by the responsible authority to ensure that it can be enforced.

8.8 [The NRA] should ensure proper coordination with national disaster and emergency preparedness agencies in developing and overseeing the implementation of the above dispositions. Such coordination should include, but may not be limited to, integrating mobile networks in multi-modal national or regional alerts systems and making available free accessible applications allowing public safety alerts to override users' handset's visual signals and ringing settings to ensure that alerts are perceived and understood to the greatest possible extent by all mobile users and persons with disabilities in particular.

9. Assistive technologies

9.1 Assistive technology (AT) is an umbrella term that includes assistive, adaptive, and rehabilitative devices for persons with disabilities and also includes the process used in selecting and using them. AT is important in that it promotes greater independence by enabling people to perform tasks that they would otherwise be unable to accomplish, or would have accomplished with great difficulty, by providing enhancements to, or changing methods of interacting with, the technology needed to accomplish such tasks. For the purposes of this policy, assistive technology, as defined, refers only to ICT assistive technologies[76]. [Country] believes that the [NRA and USAF] should ensure that assistive technologies for use with mobile handsets or services are made available on the open market by putting in place incentive schemes to improve economies of scale in purchase, production, distribution and support of these technologies.

9.2 To the extent that a large portion of assistive technologies are purchased or funded by public funds for special education, rehabilitation services, workplace accommodation or care for elderly citizens, the NRA will initiate, if not already in place, cooperation with other government agencies to optimize purchasing, training and users' support on a national basis.

9.3 The NRA, in cooperation with other government agencies, will develop a gap analysis of the availability of assistive technologies for persons with disabilities in order to identify areas for which government action may be taken, such as public procurement of office software with embedded accessibility features, free downloadable ATs or subsidized purchases of ATs[77].

9.4 When text to speech technology or voice recognition is not available in the official languages of the country, the [NRA] shall work with [the universal service fund], service providers, technology providers as well as academic institutions to call for proposals in order to develop, maintain and service such solutions.

10. Funding and incentives (universal service and access fund)

10.1 Universal service and access funds (USAFs) have ICT accessibility for persons with disabilities as a key objective. Module 1: ICT accessibility legal, policy and regulatory framework provides key provisions that will provide a sound universal service and access framework, including definitions, scope, and use of USAFs.

10.2 Recognizing the contribution that mobile operators have made to the fund, the universal service and access fund should be used to support this policy and the attainment of mobile communications accessibility targets. In particular this policy supports the notion that:

---

[76] AT also includes, for example, mobility aids such as wheelchairs.

[77] See Federal Communications Commission (FCC) programme for the distribution of equipment to deaf-blind users in the United States. www.fcc.gov/guides/national-deaf-blind-equipment-distribution-program

(a) all persons with disabilities in [Country] may be eligible for financial assistance from the Fund[78];

(b) mobile operators, service providers, software and device manufacturers, teachers, special educators and vocational trainers providing services to persons with disabilities and disability organizations may be beneficiaries of the Fund for purposes of ensuring mobile communications accessibility for persons with disabilities;

(c) the Fund may be used for spreading awareness of the available mobile services and benefits of mobile devices and assistive technologies, including new technologies, as well as other forms of assistance, support services and facilities for persons with disabilities and the rest of society[79]; and

(d) The [NRA/USAF] should collaborate with persons with disabilities, organizations of persons with disabilities, the committee on ICT accessibility[80], the mobile industry, advocates for persons with disabilities, and government organizations, amongst others, at the local, national and international level to increase the availability and utilization of accessible mobile devices and services.

10.3 Where any eligible member of the mobile communications industry can demonstrate that compliance with this mobile communications accessibility policy creates a disproportionate or undue financial burden, it may apply to the USAF for subsidization to enable compliance.

10.4 The [USAF Manager/ NRA] must, further to public consultation[81], publish guidelines defining underserved communities, which should include persons with disabilities and should provide guidance on the processes and the criteria for eligible persons to receive subsidies from the fund.

10.5 In using the USAF in line with the mandate set out in the ICT law, [the USAF Manager/ NRA] should consider using the USAF to promote mobile communications accessibility including through[82]:

(a) Subsidizing accessible handsets and/or monthly subscriptions, or a specified number of minutes per month for users qualifying as persons with disabilities;

---

[78] Each country will need to have a means of identifying persons with disabilities, i.e. recipients of disability grants, notified to operators (bearing in mind privacy provisions in law), or beneficiaries of any other schemes for persons with disabilities. If no such scheme exists, then this clause should not be included in the policy and funding should be provided only through disability groups and/or operators and suppliers to reduce the administrative burden on the USAF.

[79] As defined in the UN Convention on the Rights of Persons with Disabilities, General Obligations: 4.1(h).

[80] In order to mainstream ICT accessibility, the NRA may set up a committee on ICT accessibility in furtherance of its statutory objectives to promote the interests of users and to ensure the involvement of persons with disabilities, organizations of persons with disabilities, industry and other stakeholders in the development and implementation of all policies, regulations or industry codes from the outset. The committee on ICT accessibility will provide guidance, not only on disability policy and regulations, but on all policy and regulations which may impact on persons with disabilities – this may also include tariff regulations which should take into account special and/or discounted tariffs for certain categories of users as discussed in section 7 of this module. The committee on ICT accessibility is discussed in section 4 of Module 1: ICT accessibility legal, policy, and regulatory framework. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject to public consultation that includes persons with disabilities.

[81] See also Module 1: ICT accessibility legal, policy, and regulatory framework, section 4.

[82] Primary legislation in a country must support the objectives set out in policy. Countries should ensure that the provisions below are included in the USAF mandate in their national ICT Law and/or USAF regulations.

(b) Subsidizing the purchase of assistive technology tools by service providers, disability organizations or end-users with disabilities[83]:

(c) Funding the customization of basic assistive technology tools in local languages including text-to-speech, voice recognition, captioning applications and screen readers for the mobile environment[84];

(d) Providing incentives for research and development on localization of assistive solutions, such as development of speech-to-text engines in the official languages for the mobile environment;

(e) Facilitating awareness and promotion of universally designed mobile devices and services;

(f) Facilitating the training of professionals supporting persons with disabilities in adopting and using ICT,[85] including experts from organizations of persons with disabilities or working with persons with disabilities, such as teachers, health workers and vocational counsellors; and

(g) Facilitating the development of curricula and training of information technology professionals on mobile ICT accessibility.

10.6 The [NRA/Fund Manager] will put in place safeguards to protect against the improper use of the fund, to prevent fraud, waste and abuse so that the monies in the fund can be used for their intended purpose of ensuring universal service and access by all to ICT.

11. Targets and reporting requirements[86]

11.1 NRAs should establish, in consultation with persons with disabilities (in line with section 4 of Module 1: ICT accessibility legal, policy and regulatory framework), annual measurable targets to be implemented by the mobile industry, issue an annual public report on implementation and take necessary enforcement action where appropriate. Sample mobile accessibility policy targets are provided below.

[83] Certain countries allow individuals to apply directly for grants and subsidies, thus making it easier to "enrol" them as beneficiaries and to provide these individual end users with grants and subsidies. This requires additional institutional and administrative strength on the part of the USAF to be able to address individual applications for subsidies.

[84] This may be done in coordination with Ministry of Education – an explicit requirement can be included where the Ministry or NRA has powers to include other ministries.

[85] See Convention on the Rights of Persons with Disabilities, General Obligations: Art. 4.1 (i).

[86] Policy-makers will have to consider the number of languages spoken in each country, areas in which disabled persons are concentrated in each country and also consider information and technology that already exists in each country whose main purpose is to provide electronic/mobile accessibility to disabled persons.

Mobile accessibility policy targets	
Availability of accessible mobile products, services, and devices	
Mobile operators' and retailers' procurement policies amended	Within 12 months
A range of accessible handsets and services for different types of disabilities on offer by mobile operators and retailers	Within 18 months
Sales, retail outlets, customer care and public awareness	
Points of sale made accessible including use of internationally recognized disability and braille signage	Within 12 months
Mobile industry staff trained on key accessible products and serving users with disabilities	Within 12 months
Dedicated customer care facilities, in store support or staff at call centres trained to assist customers with disabilities	Within 12 months
Customer communications including bills, contracts with customers and publicly available terms and conditions and information about products and services made available in accessible formats	Within 12 months
Annual review of implementation of mobile communications accessibility policy/regulations	Within 12 months
Annual national survey on accessibility of mobile devices and services, including mobile assistive technology and awareness by persons with disabilities of this policy and its related [Code of conduct or] [regulations] and available accessible and assistive mobile communications (by NRA)	Within 12 months
Promotion and advertising by mobile industry of accessible mobile products and services, including accessible emergency services	Within 6 months after staff training
Funding and Incentives	
Special and/or discounted mobile rate plans for persons with disabilities available and publicly promoted	Within 18 months
Mobile code of conduct or regulations in place	Within 12 months Reviewed every 2 years
Emergency services	
Accessible mobile emergency services available	Within 12 months
Accessible mobile emergency services include ability to send texts and/or video and provide emergency agencies with callers' geo-location information which indicates that the caller is enrolled as a subscriber with a disability so that persons with disabilities are able to use their everyday mobile handsets for emergency communications	As soon as practically possible
Include accessible emergency communications requirements in [industry code of conduct or][regulations]	Within 12 months
[NRA] coordinates with national disaster and emergency preparedness agencies in developing and overseeing emergency communications requirements and with mobile operators to ensure that emergency and public safety alerts are provided in accessible formats to persons with disabilities (e.g., visual alerts for the deaf and vibration alerts for the blind).	As soon as practically possible

11.2 In addition, milestones should be set to measure progress in implementing policy, codes of conduct or regulations, capacity to implement policy, codes of conduct or regulations (e.g. establishing necessary budgets and training programmes) and progress in availability of accessible mobile communications for persons with disabilities), including access to, availability, and affordability of mobile communications based on type of disability.

11.3 Access to information about mobile communications accessibility for the disability community is critical to ensuring that future reviews of accessibility policy measures are effective and that policy interventions are evidence-based. To achieve this, the NRA should determine reporting requirements for notifying the disability community about the accessibility requirements contained in adopted policies, codes of conduct and regulations. A thorough review should be conducted by NRAs of *all* reporting requirements to ensure that the correct data is collected with respect to accessibility for persons with disabilities, at the right level of detail and at reasonable intervals[87].

12. Periodic review

12.1 Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

[87] Reporting requirements may need to be changed in regulations, depending on whether the ICT law has a specific section on reporting

Annex A: Model code of conduct on mobile communications accessibility for persons with disabilities[88]

[The Model mobile communications accessibility policy sets out the vision and key principles for the country with respect to access by persons with disabilities to mobile services, products and devices. A policy is not binding and must, in order to have force in law, be supported by either legislation, regulations or, in countries with legal frameworks that support 'soft law', codes of conduct. See Module 1: ICT accessibility legal, policy and regulatory framework, section 3 - Options for regulation.

This annex supports the mobile communications accessibility policy, which would be made by the policy-maker, i.e. the Ministry, and sets out model provisions that enable the model policy to be implemented. The model provisions set out herein are intended to be included in industry concluded codes of conduct on enabling mobile accessibility for persons with disabilities. The language in which it is currently drafted is suitable for a code of conduct and is drafted from the perspective of an industry player or signatory to the code of conduct. The code of conduct should be compliant with national legislation and should be lodged with and/or approved by the NRA as provided for in the law.]

1. Purpose of code of conduct[89]

This document sets out a code of conduct on ICT accessibility for persons with disabilities with regard to the provision of mobile communication services and products. It is [aligned with the mobile ICT accessibility policy and] designed to advise and assist the mobile industry, which includes network operators, service providers and retailers on measures to be put in place to make available to persons with disabilities accessible products and services, recognizing the widespread commercial availability of handsets and other mobile devices with embedded accessibility features[90].

2. Definitions

In this code any word or expression to which a meaning has been assigned in the mobile communications accessibility policy has the meaning so assigned, unless the context indicates otherwise.

3. Consultation

(a) The input of organizations representing persons with disabilities should be taken into account and they will be consulted in the development and monitoring of the implementation of this Code[91].

---

[88] The specific national context will have to be taken into account. Ideally, the commitments set out in this model code should be made by the mobile industry on a voluntary basis further to the finalization of the accessibility policy. The effectiveness of such an approach is dependent on the history and culture of self-regulation in the country and the presence of a strong industry association to foresee implementation. Where there is no institutional framework supporting self-regulation or co-regulation (in which case the final Code should be lodged with the regulator) then the code can be modified for publication as regulations and a model regulation is provided in Appendix B.

[89] This document may be known as the "Model code of conduct on mobile communications accessibility for persons with disabilities". If it is to be published as regulations or guidelines by the NRA, the model regulations in Annex B of Module 3 should be referred to.

[90] Although accessible features are embedded in some handsets which are commercially available in the global marketplace, some operators may opt to make available for sale only cheaper handsets with no embedded accessible features due to customer affordability concerns. This code of conduct would not prevent operators from continuing to offer such cheaper, non-accessible handsets, but would ensure that accessible handsets that are commercially available in the global marketplace are part of the operator's sales offering.

[91] If a country has established a committee on ICT accessibility for persons with disabilities, as recommended in section 4 of Module 1 (see also Box 3), then this committee should be explicitly mentioned.

(b) Mobile operators will consult disability groups about the manner in which they intend to meet their obligations under this code of conduct, and will meet with such groups on at least an annual basis to advise them of the progress on the implementation of the Code, relevant services, products and awareness-raising campaigns.

(c) Mobile operators may conduct the consultative processes jointly, including through organizations that represent persons with disabilities, to the extent that no competitive issues or issues prohibited in terms of Competition Law or any other law are discussed in the meetings.

(d) The [NRA/USAF] may be called upon by mobile operators or organizations of persons with disabilities to serve as the host and facilitator for such consultative process.

4. Functional requirements

(a) Mobile operators will strive to ensure that their products and services are accessible, usable and available to persons with disabilities.

(b) Through their own or third party distribution channels, mobile service providers will make available and promote to their customer base a selection of handsets with embedded or pre-loaded accessibility features and applications supporting users with various types of disability and which are generally available among leading handset manufacturers[92].

(c) In addition, mobile operators will make customers with disabilities aware of accessible features and applications relevant to their disabilities as well as provide other information and services such as special and/or discounted tariff plans, billing options and accessible websites.

(d) Options for making services more accessible may include the following[93]:

4.1 Deaf and hard of hearing users

Mobile operators will strive to provide on a commercial basis[94]:

- Specialized service plans such as text-only plans or text and data plans, to ensure that they pay only for the services that they are able to use, and to ensure that they benefit from discounts on such services;
- Systems to ensure that the deaf and hard-of hearing are able to access the operator's automated customer services as an alternative to those that require users to listen to several automated options and then select a channel of service using the keypad;
- Phone support services available through alternative modes such as relay service or peer to peer video communications for sign language communication with trained personnel;
- Emergency services that also provide the geo-location information of the caller, including that the subscriber is enrolled as having a disability and providing emergency alerts and public safety announcements with visual alerts.

---

[92] This has been well documented by the mobile accessibility database of the Mobile Manufacturers Forum. To view the mobile accessibility database of the Mobile Manufacturers see www.mobileaccessibility.info/index.cfm?lang=eng

[93] Mobile operators should provide options in each of the below-mentioned categories as they pertain to accessible products, service and devices available in the global market place.

[94] Where countries provide subsidies through Universal Service Access Funds (USAFs) to mobile operators for providing accessible mobile devices and services, this may be subsidized by the USAF.

- Mobile devices that are hearing-aid compatible and do not interfere with use of hearing aids[95];
- Broadband enabled devices that can offer interactive video conferencing and face-to-face calling as an alternative to texting; and
- Smart phones and tablets which support playback of video and movies with closed captioning, open captioning, audio description and subtitles[96].

Mobile operators will advise deaf and hard of hearing users of the availability of the above[97].

4.2 Blind users and users with reduced vision

Mobile operators will strive to provide on a commercial basis[98] mobile devices which have the following features[99]:

- Ability to assist the user in navigating the mobile handset (e.g. phones that support tactile markers, those that are compatible with third party keyboards and those that have full screen reader support built in);
- Audible or tactile feedback for keyboards and setting features and voice synthesizer feedback for touch screens to allow interactive description and use of icons and applications;
- The option of adjustable font size, the ability to adjust brightness and contrast controls for display, the changeable size of the main display, backlit display, basic text-to-speech functionality, screen magnification and screen readers in the official languages, which are built-in or compatible with mobile devices;
- Embedded web browsers compatible with screen reading functionalities;
- Features on phones such as audible, vibratory and or tactile cues for important notifications such as low battery, call waiting, and incoming call etc., the ability to adjust brightness and contrast controls for display, the changeable size of the main display, backlit display, basic text-to-speech functionality and screen magnifiers.

Mobile operators will advise blind users and users with reduced vision of the availability of the above. In addition mobile operators will strive to provide and blind users and users with reduced vision should be advised of:

- The mobile operator's accessible website including accessible account information;
- The option to receive bills in either large fonts or Braille or in accessible electronic formats;

---

[95] See www.fcc.gov/guides/hearing-aid-compatibility-wireless-telephones

[96] Countries must consider whether they will specify the language of captioning and the percentage to be provided in a relevant or local language.

[97] A full range of accessibility options for deaf and hard of hearing users is available in the ITU and G3ICT *Making mobile phones and services accessible for persons with disabilities report* 2012, www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf.

[98] Where countries provide subsidies through Universal Service Access Funds (USAFs) to mobile operators for providing accessible mobile devices and services, this may be subsidized by the USAF.

[99] A full range of accessibility options for the blind and users with reduced vision is available in the ITU and G3ICT *Making mobile phones and services accessible for persons with disabilities report* 2012, www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf.

4.3 Users with reduced dexterity or limited mobility

Mobile operators will strive to provide on a commercial basis[100] mobile devices which have the following features[101] :

- The option for voice recognition for basic functions including dialling numbers, writing text messages, opening and closing applications, making calendar entries, setting reminders, playing music, and surfing the web;
- Auto text or predictive text keyboards;
- Compatibility with third party switch devices; and
- Compatibility with styli or mouth-sticks

Mobile operators will advise people with reduced dexterity or limited mobility of the availability of the above.

4.4 Users with limited cognition

Mobile operators will strive to provide on a commercial basis[102] mobile devices with the following features[103].

- Predictive text capability;
- Speech recognition facilities;
- Text-to-speech applications or functions;
- Built-in calendar and schedule reminders with audio, visual and vibrating alerts;
- Larger display screens and formatting options for text that allow for more space between words;
- Customizable or highly pictorial visual display;
- How to organize icons to simplify the user interface to their needs;
- Use of universal icons that are clearly understood by all users; and
- Simple clear and consistent user interfaces

Mobile operators will advise people with limited cognition of the availability of the above. In addition, mobile operators will strive to provide and people with limited cognition should be given information about how to organize icons to simplify the user interface to their needs.

---

[100] Where countries provide subsidies through Universal Service Access Funds (USAFs) to mobile operators for providing accessible mobile devices and services, this may be subsidized by the USAF.

[101] A full range of accessibility options for users with reduced dexterity or limited mobility is available in the ITU and G3ICT – Making Mobile Phones and Services Accessible for Persons with Disabilities Report 2012 [www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf or http://g3ict.org/resource_center/publications_and_reports/p/productCategory_books/subCat_1/id_191]

[102] Where countries provide subsidies through Universal Service Access Funds (USAFs) to mobile operators for providing accessible mobile devices and services, this may be subsidized by the USAF.

[103] A full range of accessibility options for users with limited cognition is available in the ITU and G3ICT – "Making Mobile Phones and Services Accessible for Persons with Disabilities Report 2012", [www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf or http://g3ict.org/resource_center/publications_and_reports/p/productCategory_books/subCat_1/id_191]

5. Devices

(a) Mobile operators will offer customers a choice of handsets with accessible features for different kinds of disabilities in line with section 4 above, whether they sell such handsets with a pre-paid or post-paid subscription.

(b) As part of their procurement policy, mobile operators will encourage terminal and device manufacturers to[104]:

i. Develop products and services that are usable by and accessible to persons with disabilities, as part of their new product development;

ii. Develop a procurement strategy to make accessible devices available to users with all forms of disability;

iii. Encourage manufacturers to provide instructions which are in accessible formats and are easy to follow and use for persons with disabilities;

iv. Include accessibility requirements for mobile handset manufacturers and encourage distributors to offer a choice of handsets with accessible features for different kinds of disabilities.

6. Applications

(a) Mobile operators and service providers will make any applications they develop or preload on the devices they sell to customers accessible to persons with disabilities and ensure that their own app store is accessible.

(b) Mobile operators and services providers will encourage business partners and others to develop accessible applications (‘apps’) and accessible ‘app stores’ for persons with disabilities.

7. Retail outlets

(a) Service providers should make existing points of sale such as showrooms and kiosks accessible to the greatest possible extent by following universal design principles.

(b) Wherever possible, service providers will use internationally recognized disability signage as well as braille signage. Examples of internationally recognized disability signage are the eye symbol to indicate aids are available for blind and partially sighted people, ear symbol with a "T" to show that an audio induction loop is installed in a retail shop and a wheelchair symbol to indicate that ramped or level access is available at a retail store.

(c) Internationally recognized disability signage should also be used on packaging and in publicity material where products are designed, customised or are otherwise suitable for customers with disabilities to use.

(d) Mobile operators and service providers will:

i. Train staff on how to serve customers with disabilities and to be knowledgeable on all available accessible features for people with different kinds of disabilities or be able to access and share resources that provide this information.

ii. Strive to ensure that customers with disabilities are able to purchase services, devices and accessories at company owned, operated or controlled locations, using a range of alternative channels – for example, retail shops, call centres, the Internet, and direct sales via phone.

[104] As equipment manufacturers are not regulated, the most effective approach would be to mandate mobile operators to require them to develop accessible products.

iii. Ensure that selected points of sale across the country offer a complete range of accessibility services including accessible facilities, the means to respond to requests to receive information in alternative modes such as Braille documentation, and have qualified personnel trained to address the specific needs of users with a wide range of disabilities. Such selected points of sale should be advertised so that persons with disabilities are aware of their location.

iv. Offer a range of payment mechanisms to enable disabled or elderly customers to top-up pre-paid mobiles or pay for their phone services automatically (for example, by direct debit or credit card at the end of a billing period); and

v. Offer a means to ensure customers with disabilities have real time access to information regarding usage, fees and other information required to control costs including but not limited to flat rate and other special tariff plans.

8. Emergency services

(a) Emergency services via text should be available from all phones that support texting within *[one year]*, and via relay services[105]. Persons with disabilities requiring assistance from emergency services must be able to communicate via short messaging service (SMS or text) and/or relay services with those providing emergency services at no charge and, if out of range from their service provider's network, via any compatible network available.

(b) When SMS and text messaging is used:

i. Emergency services should provide acknowledgement of receipt accessible to the sender to say that the emergency contact has been received, the emergency is being handled and when emergency services will arrive on site.

ii. If the SMS or text call is unable to be completed, carriers of the text message shall whenever possible return a 'bounce-back' message to the sender that indicates that the emergency services centre was unable to receive the call.

(c) Service providers will provide emergency call centres with callers' geo-location information which also indicates that the caller is enrolled as a subscriber with a disability where this information is available to the operator and can be shared with the emergency call centre without violation of privacy laws.

(d) Public safety and emergency alerts will be made accessible, including visual alerts for the deaf and vibrating alerts for the blind.

(e) Public awareness specifically on how persons with disabilities can contact and use emergency services is mandatory and is the responsibility of the mobile operators, service providers, emergency call centres, and public bodies with responsibility for emergency services. Persons with disabilities shall be represented in forums to coordinate, plan and assess awareness efforts. Information made available to the public should also be provided in accessible formats in the official languages.

(f) Persons with disabilities shall have equal access to emergency services. This will be facilitated via voice, video, text, captions and relay, as applicable, on all mobile platforms[106].

9. Customer care

(a) Mobile operators will, where practicable, provide operator assistance and other services by setting up dedicated customer care facilities to assist customers with disabilities or by training

[105] See definition of relay services in Box 1, Module 1: ICT accessibility legal, policy and regulatory framework.

[106] The regime for emergency services via the web must be carefully considered. In some countries, web-based services such as Voice over IP service are required to explicitly state that they do not provide emergency services due to technological limitations; where this is the case, such notification must be provided in an accessible format.

dedicated staff at all call centres to assist customers with disabilities These dedicated customer care centres/staff should offer to assist customers with disabilities with support and information in sign language, via relay and through other such accessible mediums. Training of Licensee personnel should include disability awareness, etiquette when addressing persons with disabilities, understanding barriers to accessing devices and services and expertise in solutions offered by Licensee.

(b) Mobile operators will provide assistance and other services at their call centres, including assistance to individuals applying for a mobile telephone service, responses to queries on the use of equipment or customer accounts, and explanations of contract terms and conditions. Such assistance must be made available in the format requested by the customer including verbally or in an e-mail format and within a response time comparable to that available to customers without disabilities.

(c) Telephone bills, contracts with customers, including publicly available terms and conditions and information about the services provided to comply with the licence conditions, should be made available in accessible formats, which may include verbal, written (including in Braille), electronically (e.g. via e-mail), and in the official language understood by the customer, upon request.

(d) Where a mobile operator provides directory services, it shall ensure that all end users of its services, including persons with disabilities, can access, free of charge, directory information and directory enquiry facilities in a form which is appropriate to meet their needs. If a charge is incurred for these services, people with disabilities should not incur a greater cost than others.

(e) Where a licensee provides a relay service, it shall provide the service free of charge to individuals with disabilities who cannot effectively use handsets to complete calls.

10. Public awareness and advertising

(a) [Mobile operators may use a seal indicating that they are compliant with this code of conduct on their products and services, or in their retail spaces[107]].

(b) Advertisements and promotions for products and services specifically designed for persons with disabilities should be made available in accessible formats to relevant organizations of and for persons with disabilities in every region, at least upon the launch of the product, when there are significant upgrades or at further occasions upon request.

(c) Service providers should advertise their products and services in specialised and mainstream publications.

(d) Service providers should:

i. inform customers on the range of specialized products and services suitable for use by persons with disabilities;

ii. upon request, provide information about their products and services in accessible formats, for example Braille, large print, electronic or audio formats and also in the official languages;

iii. upon request, provide terms and conditions in accessible formats for visually impaired people before, during, or very soon after, a customer has entered into a legal contract with the service provider once notified of their disability;

[107] The mobile industry may wish to design a seal/logo to demonstrate compliance with this code of conduct as a means of promoting awareness and incentivizing participation by the industry. If such seal is designed, it should be published as an appendix to this code of conduct.

iv. record[108] customer's preferred contact method and preferred format for communication and use the customer's preferred formats for all communications, in particular for directed communications related to accessibility by persons with disabilities; and

v. provide a flexible return policy for a set period of time where a product is deemed unusable by a customer due to lack of accessibility features not identified in the sales process.

11. General requirements

(a) A mobile operator or service provider may not refuse to serve a person with a disability due to the operator's inability to provide relevant products or services.

(b) Each licensee shall ensure that all its employees that deal with customers and the public receive sensitivity training on a regular basis (at least once every [two] years). Such training should include information about the culture, languages, as relevant and societal norms of persons with disabilities.

(c) All mobile operators should make information available about products and services offered in a choice of accessible formats such as braille, audio or large print without additional charge.

(d) All mobile operators shall provide product or service information in a timely fashion and in simple understandable language, to persons with disabilities either verbally through a call centre, via relay services or in an electronic format such as e-mail.

(e) Licensee websites must be designed to be accessible and are required to be compliant with the standards set out in Module 5: Web accessibility policy framework.

(f) Customers may reasonably be encouraged to inform their service provider of their individual requirements, and service providers may not record such requirements for marketing and customer service purposes, unless authorized by the customer to do so.

(g) Where such information is provided by a person with a disability, it is good practice to keep records of the customer's requirements, provided that the information is stored with the customer's permission in accordance with data protection and privacy obligations and may include the format in which the customer would like to receive billing information or targeted marketing material.

12. Implementation roadmap

(a) Mobile operators will ensure that the actions required in terms of this code of conduct are met within the timeframes set out hereunder:

MOBILE OPERATORS CODE OF CONDUCT ON MOBILE COMMUNICATIONS ACCESSIBILITY IMPLEMENTATION ROADMAP	
Requirement as set out in the code of conduct	Compliance Date[109]
AVAILABILITY OF ACCESSIBLE MOBILE PRODUCTS, SERVICES AND DEVICES	
Mobile operators' and retailers' procurement policies amended	Within 12 months
A range of accessible handsets and services for different types of disabilities on offer by mobile operators and retailers	Within 18 months

[108] This information can be recorded on service providers' customer service management systems with the customer's agreement and when feasible and permissible.

[109] The timeframes are proposals to be agreed by the parties in drafting the final document, subject to appropriate consultation

SALES, RETAIL OUTLETS, CUSTOMER CARE AND PUBLIC AWARENESS	
Points of sale made accessible including use of internationally recognized disability signage and braille signage	Within 12 months
Mobile industry staff trained on key accessible products and serving users with disabilities	Within 12 months
Dedicated customer care facilities, in store support or staff at call centres trained to assist customers with disabilities	Within 12 months
Customer communications including bills, contracts with customers and publicly available terms and conditions and information about products and services made available in accessible formats	Within 12 months
Provide required information as part of the annual review of implementation of mobile communications accessibility policy/regulations conducted by the NRA	Within 12 months
Provide required information for the annual national survey conducted by the NRA on accessibility of mobile devices and services, including mobile assistive technology and awareness by persons with disabilities of this policy and its related code of conduct and available accessible and assistive mobile communications	Within 12 months
Promotion and advertising by mobile industry of accessible mobile products and services, including accessible emergency services	Within 6 months after staff training
FUNDING AND INCENTIVES	
Special and/or discounted mobile rate plans for persons with disabilities available and publicly promoted	Within 18 months
Mobile code of conduct in place	Within 12 months Reviewed every 2 years
EMERGENCY SERVICES	
Accessible emergency communications requirements included in industry code of conduct	Within 12 months
Accessible mobile emergency services available	Within 12 months
Accessible mobile emergency services include ability to send texts and/or video relay and emergency call centres provided with callers' geo-location information which indicates that the caller is enrolled as a subscriber with a disability so that persons with disabilities are able to use their everyday mobile handsets for emergency communications	As soon as practically possible
Emergency and public safety alerts are provided in accessible formats to persons with disabilities (e.g., visual alerts for the deaf and vibration alerts for the blind).	As soon as practically possible

13. Review of code of conduct

(a) Mobile operators shall report to the NRA on an annual basis on the progress of implementation of this code of conduct.

(b) This code of conduct should be reviewed by the mobile industry at least every two years; any review should follow the consultation process described in section 3 of this code of conduct.

Annex B: Regulations in terms of section [X] of the [ICT law] for mobile communications accessibility for persons with disabilities

[The Model mobile communications accessibility policy sets out the vision and key principles for the country with respect to access by persons with disabilities to mobile services, products and devices. A policy is not binding and must, in order to have force in law, be supported by either legislation or regulations. In countries with legal frameworks that support 'soft law' or self-regulatory regimes, policy should be supported by codes of conduct, see Module 1, section 3 - Options for regulation.

This annex supports the Model mobile communications accessibility policy, which would be made by the policy-maker, i.e. the Ministry, and sets out model regulatory provisions that enable the model policy to be implemented for countries that do not use codes of conduct. The model provisions set out herein are intended to be included in regulations made by enabling mobile accessibility for persons with disabilities. The language in which it is currently drafted is suitable for regulations and is drafted from the perspective of the NRA. The NRA may take into account the level of compliance of licensees at the time of the renewal of their licences and include specific language referencing this regulation when offering licences to new operators.]

1. Purpose

1.1 The Model mobile communications accessibility policy sets out the vision and key principles for the country with respect to access by persons with disabilities to mobile services, products and devices. These regulations support the Model mobile communications accessibility policy.

These regulations on mobile communications accessibility for persons with disabilities apply to the provision of services and products by licensed mobile operators.

2. Definitions

2.1 In these regulations any word or expression to which a meaning has been assigned in the law, policy and regulatory framework and the Model mobile communications accessibility policy has the meaning so assigned, unless the context otherwise indicates.

- **"Licensees"** means licensed mobile operators and includes their service providers[110].
- **"Retail outlet"** means a physical area where mobile products and services are made available for sale, lease or rental. This includes shops, stalls and kiosks.

3. Consultation

3.1 Licensees must consult with disability groups about the manner in which they should meet their obligations under these regulations, and must meet with such groups on an [annual] basis to advise them on the progress with respect to the implementation of the regulations, relevant services, products and campaigns.

3.2 Licensees may conduct the consultative processes set out in regulation 3(1) jointly, including through organizations that represent persons with disabilities, to the extent that no competitive issues or issues prohibited in terms of Competition Law or any other law are discussed in the meetings. The NRA should convene such meetings, where feasible.

[110] The term licensees may be defined differently depending on jurisdiction. In some jurisdictions where converged licensing frameworks are in place, mobile operators may hold two or more licences. Typically they will hold network licences (for the infrastructure) and service licences (for the services). These regulations apply mainly to the service licences, and to the mobile operators' retail or customer facing business. The provisions relating to emergency services relate both to the mobile network and services.

4. Basic services and functional requirements

4.1 Licensees must ensure that their products and services are accessible and available to persons with disabilities.

4.2 Licensees shall make available and promote to their customer base a selection of handsets with embedded or pre-loaded accessibility features and applications supporting users with various types of disability and which are generally available among leading handset manufacturers, through their own or third party distribution channels[111].

4.3 In addition, licensees are required to make customers with disabilities aware of accessible features, as well as provide other information and services such as special tariff plans, billing options and accessible websites.

4.4 Licensees must ensure that the needs of people who are deaf or hard of hearing are addressed and that they are advised of and provided the following services and devices, amongst others[112]:

4.4.1 Specialized service plans, such as text only plans or text and data plans, to ensure that they pay only for the services that they are able to use, and to ensure that individuals with specific communications needs are not disproportionately charged for the facilitation of equivalent functionality[113].

4.4.2 Alternate means or systems to ensure that the deaf and hard-of hearing are able to access automated customer services that require users to listen to several automated options and then select a channel of service using the keypad.

4.4.3 Telephone support services available through alternative accessible modes such as relay service, accessible real time on-line support, or peer-to-peer video communications for sign language with trained personnel;

4.4.4 Emergency services via text, which services should be available from all phones that enable texting within *[*one year*]* and via video relay services;

4.4.5 Emergency and public safety alerts in accessible formats to persons with disabilities (e.g. visual alerts for the deaf and vibration alerts for the blind).

4.4.6 Devices that are hearing-aid compatible and do not cause user or bystander interference[114];

4.4.7 Information displayed on product packaging and in product manuals, which provide detailed information on hearing aid compatibility of the products.

4.4.8 A means for consumers to test hearing aid-compatible handsets in licensee owned or operated retail stores.

---

[111] Although accessible features are embedded in some handsets which are commercially available in the global marketplace, some operators may opt to make available for sale only cheaper handsets with no embedded accessible features due to customer affordability concerns. These regulations would not prevent operators from continuing to offer such cheaper, non-accessible handsets, but would ensure that accessible handsets that are commercially available in the global marketplace are part of the operator's sales offering. The availability of accessible handsets has been well documented by the mobile accessibility database of the Mobile Manufacturers Forum. To view the mobile accessibility database of the mobile manufacturers see www.mobileaccessibility.info/index.cfm?lang=eng

[112] A full range of accessibility options for deaf and hard of hearing users is available in the ITU and G3ICT *Making mobile phones and services accessible for persons with disabilities report* 2012.

[113] For example, it may be appropriate to provide specialized rate plans for data for people who are deaf, if providing video is the functional equivalent for those who use sign language as basic voice services is to those who can communicate by voice.

[114] See www.fcc.gov/guides/hearing-aid-compatibility-wireless-telephones

4.4.9 Broadband enabled mobile devices that can offer interactive video conferencing and face-to-face calling as an alternative to texting; and

4.4.10 Smart phones and tablets which support playback of video and movies with closed captioning, open captioning, and subtitles[115].

4.5 Licensees must ensure that the needs of blind users and users with reduced vision are addressed and that they are advised of and provided the following services and devices, amongst others[116]:

4.5.1 Information and services via an accessible website, including accessible account information;

4.5.2 An option to receive billing in either large fonts or braille, or accessible electronic formats;

4.5.3 The availability of mobile devices that have tactile markers on the keypads or overlays that assist in device navigation; where these are not available they should offer mobile devices compatible with third party keyboards;

4.5.4 Mobile devices with audible or tactile feedback for keyboards and setting features and voice synthesizer feedback for touch screens to allow interactive description of icons and applications through voice output and compatibility with Braille devices where feasible;

4.5.5 Mobile devices which have the option of an adjustable font size, the ability to adjust brightness and contrasts controls for display, changeable size of the main display, backlit display, basic text-to speech functionality, screen magnifications;

4.5.6 Screen readers in official languages, built-in and/or compatible with mobile devices or software provided and installed with assistance if needed;

4.5.7 Embedded web browsers compatible with screen reading functionalities; and

4.5.8 Features on phones such as audible, vibratory or tactile cues for important notifications such as low battery, call waiting, and incoming call etc., the ability to adjust brightness and contrast controls for display, changeable size of the main display, backlit display, basic text-to-speech functionality and screen magnification through the display.

4.6 Licensees must ensure that the needs of people with reduced dexterity or limited mobility are addressed and that they are advised of and provided mobile devices which have, amongst others:

4.6.1 The option for voice recognition for basic functions including dialling numbers, writing text messages, opening and closing applications, making calendar entries, setting reminders, playing music, and surfing the web[117]; and

4.6.2 Predictive text capability;

4.6.3 The ability to be operated by an external switch connected to the device either with an embedded interface or through a readily available, free downloadable application.

4.7 Licensees must ensure that the needs of people with limited cognition are catered for and that they are advised of and provided mobile devices with[118]:

4.7.1 Predictive text capability;

4.7.2 Speech recognition;

---

[115] Countries must consider whether they will specify the language of captioning and the percentage to be provided in a relevant or local language.

[116] A full range of accessibility options for example for blind users and users with reduced vision, users with reduced dexterity or limited mobility, and for users with limited cognition is available in the ITU and G3ICT *Making mobile phones and services accessible for persons with disabilities report* 2012: www.itu.int/ITU-D/sis/PwDs/Documents/Mobile_Report.pdf

[117] Idem.

[118] Idem.

4.7.3 Text-to-speech applications or functions;

4.7.4 Built-in calendar and schedule reminder with audio, visual and vibrating alerts.

4.7.5 Larger display screens and formatting options for text that allow for more space between words;

4.7.6 Highly pictorial or customizable visual display;

4.7.7 Use of universal icons that are clearly understood by all users; and

4.7.8 Simple clear and consistent user interfaces.

5. Procurement of devices

5.1 In implementing the obligations set out in section 4 of these regulations, licensees, whether they provide handsets with pre-paid or post-paid subscriptions, shall require from handset manufacturers and their distributors to procure the latest available accessibility features available on the global market place[119].

5.1 As part of their procurement policy, licensees shall strive to encourage terminal and device manufactures to[120]:

(a) develop products and services that are usable by and accessible to persons with disabilities, as part of their new product development;

(b) provide instructions which are in accessible formats and are easy to follow and use for persons with disabilities;

(c) offer them a choice of handsets with accessible features for different kinds of disabilities; and

(d) to retain commonly used modes of accessible communication and not remove them as devices and services are further developed

6. Retail outlets

6.1 Within [12 months] of promulgating these regulations, licensees must ensure that their retail outlets and points of sale are accessible to the greatest possible extent by following universal design principles.

6.2 Wherever possible, licensees must ensure that service providers should use internationally recognized disability signage[121] and braille signage.

6.3 Internationally recognized disability signage should be used on packaging and in publicity material where products are designed, customised or are otherwise suitable for customers with disabilities to use, in collaboration with organizations of persons with disabilities, the Committee on ICT Accessibility[122] and the mobile industry.

---

[119] The latest available accessible features are well documented by the mobile accessibility database of the Mobile Manufacturers Forum. See www.mobileaccessibility.info/index.cfm?lang=eng

[120] As equipment manufacturers are not regulated, the most effective approach would be to mandate mobile operators to require them to develop accessible products.

[121] Examples are the eye symbol to indicate aids are available for blind and partially sighted people, ear symbol with a T to show that an audio induction loop is installed in a retail shop and a wheelchair symbol to indicate that ramped or level access is available at a retail store.

[122] In order to mainstream e-accessibility, the NRA may set up a committee on ICT accessibility in furtherance of its statutory objectives to promote the interests of users, and to ensure the involvement of organizations of persons with disabilities in

6.4 Within [12 months], licensees must:

(a) Train staff on how to serve customers with disabilities and to be knowledgeable or be able to retrieve resources and information on all available accessible features for people with different kinds of disabilities.

(b) Ensure that customers with disabilities are able to purchase services, devices and accessories using a range of alternative accessible channels. For example, retail outlets, call centres, the Internet, and direct sales via the phone.

(c) Ensure that selected retail outlets across the country offer a complete range of accessibility services including accessible facilities, alternative modes of communications such as Braille documentation or sign language interpreting in a timely manner, upon request. Such outlets should employ qualified personnel trained to address the specific needs of users with a wide range of disabilities and the locations of these centres should be advertised.

(d) Offer a range of payment mechanisms to enable disabled or elderly customers to top-up pre-paid mobiles, or pay for their phone services automatically, for example by direct debit or credit card at the end of a billing period, at no additional charge.

(e) Offer a means to ensure that customers with disabilities have real time access to information regarding usage, fees and other information required to control costs.

7. Emergency services

7.1 Licensees must ensure that citizens with disabilities requiring assistance from emergency services should be able to make a mobile phone call or communicate via SMS and relay at no charge and, if out of range from their service provider's network, via any compatible network available.

7.2 Within [24 months], licensees must provide an accessible emergency service that allows deaf or hearing impaired individuals to send an SMS or text in case of emergency and must provide:

(a) An acknowledgment of receipt, via real time text, to the sender; and

(b) A 'bounce back' message indicating that the emergency services centre was unable to receive the call, if the SMS or text call is unable to be completed.

7.3 Where available and practicable, licensee must provide emergency call centres with callers' geo-location information which also indicates that the caller is enrolled as a subscriber with a disability where this information is available to the operator and can be shared with the emergency call centre without violation of privacy laws.

7.4 Within one year licensees must provide emergency and public safety alerts in accessible formats to persons with disabilities (e.g., visual alerts for the deaf and vibration alerts for the blind).

7.5 Licensees are required to ensure public awareness is provided specifically on how persons with disabilities can contact and use emergency services. Information made available to the public should also be provided in alternative formats, upon request.

8. Customer care

8.1 Licensees must provide operator assistance and other services by setting up dedicated customer care centres to assist customers with disabilities or by training[123] dedicated staff at all call centres. They should offer dedicated voice-based and online channels of communication that offer support and

the development of all policies, regulations or industry codes from the outset. The committee on ICT accessibility will provide guidance, not only on disability policy and regulations, but on all policy and regulations which may impact persons with disabilities – this may range from tariff regulations (which should take into account special and/or discounted tariffs for certain categories of users as discussed in section 7 of the model mobile communications accessibility policy in this module.) The committee on ICT accessibility is discussed in section 4 of Module 1 of this report.

[123] In particular, for smaller operators.

information in sign language, via relay and through other such accessible mediums. Training of Licensee personnel should include disability awareness, etiquette when addressing persons with disabilities, understanding barriers to accessing devices and services and expertise in solutions offered by Licensee.

8.2 Licensees must provide assistance and other services at their call centres, retail outlets and support centres, including assistance to individuals applying for a mobile telephone service, responses to queries on the use of equipment or customer accounts, and explanations of contract terms and conditions. Such assistance must be made available in the format requested by the customer including verbally or in an e-mail format within a response time comparable to that available to customers without disabilities.

8.3 Bills and contracts with customers, including publicly available terms and conditions and information about the services provided, must be made available in accessible formats upon request and at no additional cost to the consumer. This may include verbally, in writing, including in braille, and in simple a language.

8.4 Where a licensee provides directory services, it shall ensure that all end users of its services, including persons with disabilities, can access, free of charge, directory information and directory enquiry facilities in a form which is appropriate to meet their needs[124].

8.5 Where a licensee provides a relay service, this service should be provided free of charge to individuals with disabilities who cannot effectively use handsets to complete calls.

9. Public awareness and advertising

9.1 Advertisements and promotions for products and services specifically designed for persons with disabilities must be made available in accessible formats to relevant organizations of and for persons with disabilities in every region at least upon the launch of the product, on the occasion of significant upgrades or at further occasions upon request.

9.2 Licensees must:

(a) Advertise their products and services in specialized and mainstream publications;

(b) Inform customers of the range of specialized products and services suitable for use by persons with disabilities;

(c) Provide information about their products and services in accessible formats, for example Braille, large print, electronic or audio formats, upon request and in a timely manner; and also in official languages;

(d) Provide terms and conditions in accessible formats for visually impaired people before, during, or very soon after, a customer has entered into a legal contract with the service provider, once the licensee has been notified of their disability;

(e) Subject to customer agreement and privacy protections, use preferred formats for direct marketing information sent to customers who have identified themselves to the service providers as having difficulty using a product or service because of a disability.

(f) Where a product is deemed unusable by a customer due to lack of accessibility features not identified in the sales process, provide a flexible return policy for a set period of time.

10. Universal service and access fund subsidies

10.1 Licensees may apply to the [USAF] for support to meet any of the requirements set out in these regulations where they can demonstrate a disproportionate or undue financial burden.

[124] This clause may be included in a mobile operator's licence in regimes where the licensee is required to provide directory services in terms of its licence.

11. General requirements

11.1 A licensee may not refuse to serve a person with a disability due to the licensee inability to provide relevant products or services.

11.2 Each licensee shall ensure that all its employees that deal with customers and the public receive sensitivity training on a regular basis, at least once every [two] years. Such training should include information about the culture, languages, as relevant and societal norms of persons with disabilities.

11.3 All licensees must make information available about products and services offered in a choice of accessible formats such as braille, audio or large print, upon request and without additional charge.

11.4 All licensees shall provide product or service information in simple, understandable language and in a timely fashion to persons with disabilities either verbally through a call centre, via relay services or in an electronic format such as e-mail.

11.5 Licensee websites should be designed to be accessible and are required to be compliant with the standards set out in Module 5: Web accessibility policy framework.

11.6 Licensees may encourage their customers to inform them of their individual requirements, and, where authorized, the licensee may record such requirements for appropriate targeted marketing and customer service purposes. Where such information is provided by a person with a disability, the information must be stored with the customer's permission in accordance with data protection and privacy obligations.

11.7 Licensees should report [every six months] to the [NRA] on the progress of implementation of these regulations.

12. Contraventions and penalties

12.1 In terms of [relevant section of ICT Law], the NRA may impose sanctions for non- compliance with these regulations[125].

13. Review of regulations and compliance standards

13.1 These regulations should be reviewed at least [every two years], and in conducting the review the NRA should:

13.1.1 Take into consideration the reported outcomes of the licensee driven consultative processes set out in sections 3.1 and 3.2 of these regulations during the period under review; and

13.1.2 Consult with disability groups about their requirements and the manner in which the licensees should meet their obligations under these regulations.

[125] The sanctions must be as provided for in the country's ICT law. This may include fines and penalties. The NRA may wish to include a generic provision as proposed, or may wish to provide more detail. If more detail is required, the NRA should set out the applicable sanctions for non-compliance with these regulations (which will differ across jurisdictions) in this part of the regulations.

Module 4: Television/video programming accessibility policy framework[126]

The television/video programming accessibility policy framework module [127] has been developed for policy-makers, regulators and other stakeholders active in broadcasting and/or disability issues, including non-governmental organizations (NGOs), organizations of persons with disabilities and parliamentarians, depending on country specifics. This module provides a framework for countries to put in place a policy which promotes television/video programming accessibility. The focus includes not only the content itself, but also the information and devices needed by people to enjoy television.

This Model television/video programming accessibility policy recognizes that some countries have not yet migrated to digital television and may have legal and regulatory frameworks that refer only to "television" and/or "broadcasting." Nevertheless, television is rapidly going digital, using a variety of platforms. Therefore this policy also uses the term "video programming," which means all types of transmitted programming provided or distributed by licensed service providers, in order to allow for broader application of the policy in countries that have already migrated to digital platforms or are about to do so. Countries can use the term which best applies to their own environment.

This policy can be used in an analogue environment, but the emphasis of the model policy is on making digital television accessible. Television on the Internet can also be addressed using this module, read with the web accessibility module in this report, and this is highlighted in the relevant areas in the module, which provides guidance in areas where policy proposals can be amended to meet national circumstances.

The Model television/video programming accessibility policy has been prepared pursuant to the United Nations Convention on the Rights of persons with disabilities (the Convention), and in line with the International Telecommunication Union (ITU) and G3ict ICT Accessibility Policy Toolkit for persons with disabilities (www.e-accessibilitytoolkit.org). The Convention provides that signatories are responsible for ensuring ICT accessibility; and this model policy is designed to assist signatory countries develop a policy framework to achieve this. Countries can adopt these policy and regulatory provisions even if they are not signatories to the Convention.

Successful implementation of the goals set out in the Convention relies on the adoption and early implementation of television/video programming accessibility policies by a country. Each country has to decide on the respective policies and the timing for their implementation in accordance with its unique circumstances.

The goal of this model policy is to assist countries to create a policy framework which promotes television/video programming accessibility for persons with disabilities by taking the following steps:

- Adopting a television/video programming accessibility policy, either as a stand-alone document or integrated into an existing policy;

---

[126] The model television/video programming accessibility policy framework module addresses all forms of video programming whether transmitted over traditional broadcasting, digital, Internet Protocol television (IPTV), cable, satellite TV, hybrid broadcasting broadband television (HBB TV) or integrated broadcast broadband system (IBB) networks. The approach is technology neutral and the aim of the policy is to ensure that whatever the platform persons with disabilities face no barriers in watching programmes or using electronic programming guides (EPGs), remote control devices or TV devices. Depending on each national legal and regulatory framework, they may wish to adapt the title and terminology to refer to the "television," "video programming", "audiovisual" or "broadcasting" accessibility policy.

[127] For the purposes of this policy, and bearing in mind the jurisdiction of ICT Ministries and NRAs, the scope of the television/video programming accessibility policy framework module addresses traditional broadcasting, digital and IPTV, cable, satellite TV as well as hybrid broadcasting broadband television (HBB TV) and integrated broadcast broadband system (IBB) – all of which are regulated services. Definitions should be amended to ensure they comply with definitions for video programming applicable in the individual country. The approach of this module is technology neutral. The aim of the policy is to ensure that persons with disabilities face no barriers in watching programmes or using electronic programming guides (EPGs), remote control devices or TV devices, regardless of the platform used.

- Consulting with persons with disabilities on the development of a television/video programming accessibility policy;
- Making persons with disabilities and organizations of persons with disabilities aware of this policy and television/video programming access services[128];
- Licensed service providers delivering access services such as audio description, audio subtitles, closed captions and signing;
- Ensuring that electronic programming guides (EPGs) indicate, using internationally recognized access service icons such as "CC" for closed captions and "AD" for audio description, video programmes that offer access services;
- Establishing targets and reporting requirements for delivery of access services by licensed service providers, giving priority to certain types of programmes such as news programmes;
- Licensed service providers encouraging content creators to deliver programmes with access services;
- Licensed service providers ensuring that emergency information and public safety announcements are transmitted using access services;
- Adopting technical standards for interoperable television/video programming services to enable users to receive, decode and display access services;
- Adopting quality of service standards for access services;
- Training customer service staff on how to serve customers with disabilities, including explaining how they can find information about access services on EPGs as well as how to use and customize available access services, and by designating a single point of contact for information and complaints about access services;
- Providing adequate funding to public broadcasters to enable them to provide accessible television/video programming; and
- Promoting fair and equitable representation of persons with disabilities in video programmes.

Because of the rapid advances in technological developments, countries are encouraged to adopt processes to conduct periodic reviews of the policy and any related code or regulations, to best harness these technological opportunities.

[128] See definition of "access services" in Definitions below.

Model television/video programming accessibility policy

1. Definitions

- **"Access service"** means a service such as audio description, closed captioning and signing that improves the accessibility of a video programme for persons with disabilities.
- **"Audio description"** is a feature of a broadcasting that inserts audio narrated descriptions of key visual elements at the natural pauses between the programme's dialogues, typically after production of the video content is complete. The feature, which describes information which is not provided from the audio track, allows the video content to be accessible to those with visual disabilities. It is sometimes also referred to as "video description" or "described video".
- **"Audio subtitles"** is a feature of broadcasting developed for foreign language television programmes or films that include captions or subtitles in the broadcasting country's national language to make them accessible to viewers with vision or reading impairments (e.g. where an Italian television show is broadcast in France with French subtitles). The audio subtitles read aloud subtitles in the national language. Audio subtitles are also referred to as "audio captioning" or "spoken subtitles[129]" and are primarily used in subtitling countries that broadcast foreign audio-visual content.
- **"Closed captioning"** is the means by which both the audio dialogue and sound representations of a video programme are made visible on demand by the user via on-screen text that is synchronized with the audio content. Closed captions allow content to be accessible to those who cannot hear the audio. Some jurisdictions use the term sub-titling for the deaf and hard of hearing (SDH). This Model television/video programming accessibility policy uses the term "closed captioning" to refer also to SDH.
- **"Consumer protection policy"** consists of laws, frameworks and organizations designed to protect the rights of consumers as well as fair trade competition and the free flow of truthful information in the marketplace.
- **"Electronic programme guide" (EPG)** is an application to list current and scheduled programmes that are or will be available on each channel, a short summary or commentary for each programme and programme information[130]. EPG is the electronic equivalent of a printed television programme guide.
- **"Licenced service provider"** refers to the entity responsible for delivering television/video programming according to each country's national legal and regulatory framework, including broadcasters, cable and satellite network operators and other licensed video programming services intended for reception by the public.
- **"Open Captioning"** is captioning whereby the user does not have to do anything in order to see captions or subtitles for the deaf and hard of hearing , as they are an integral part of the picture and cannot be turned off.

[129] For countries in which a considerable proportion of programmes are in foreign languages and are available with subtitles in a national language, audio subtitles can be required in order to increase the overall availability of content access services for persons with visual or reading impairments.

[130] Electronic Programming Guides are available in countries with cable or satellite TV, and who have migrated to digital terrestrial television. The definition and section on EPG will only be applicable in countries with digital, cable or satellite television.

- **"Programme Information"** means an indication of which video programmes are accompanied by internationally recognized access service icons such as the following upper-case letters – closed captioning (CC), subtitling for the deaf and hard of hearing (SDH), signing (SL) and audio description (AD).
- **"Television broadcasting" or "Television"**[131] means the transmission whether analogue or digital, by wire or over the air in un-encoded or encoded form of video programming and electronic programme guides or both intended for reception by the public][132];
- **"Video programming"** means all types of transmitted programming provided or distributed by a licensed service provider, including broadcasters, cable, satellite, and the retransmission of their video programming on the Internet[133], intended for reception by the public.

2. Effective date and application

2.1 This policy may be cited as the "[television or] [video programming] accessibility policy", and shall come into effect upon publication in the [official government publication] and in other fora in an accessible format.

2.2 [Insert relevant provision of legislation] provides that [the Ministry and the NRA[134]] are the bodies responsible for making national policy to promote universal service and universal access in the broadcasting sector, including access by persons with disabilities to television.

2.3 This policy applies to the provision of video programming, regardless of platform including traditional broadcasting, digital and Internet Protocol television (IPTV), cable, satellite TV as well as hybrid broadcasting broadband television (HBB TV) and integrated broadcast broadband system (IBB) networks, and including on-line programming (on the Internet) such as video-on-demand and catch-up services, electronic programming guides, programme information services, related end-user equipment and emergency communications services[135].

2.4 The focus of this policy is not only on the content itself, but also on the information and devices needed by people to enjoy television. Where television is provided over equipment such as a personal computer or handheld device (e.g. smartphone) running a software application or accessing a website, this policy should be read in conjunction with the model mobile communications accessibility policy (Module 3) and the model web accessibility policy (Module 5).

---

[131] The definition of "television broadcasting" or "television" may differ from country to country depending on a particular country's circumstances and policy objectives. For example, according to the ITU, **"broadcasting"** refers to a form of unidirectional telecommunication intended for a large number of users having appropriate receiving facilities, and carried out by means of radio or by cable networks. **"Broadcasting Service"** refers to radiocommunications in which transmissions are intended for direct reception by the general public. These may include sound transmissions, television transmissions and other types of transmission. However, other countries include satellite services in their definition. In addition more advanced services like video on demand (VOD) are also regulated in some countries. The definition of "TV broadcasting" that is already adopted in a country must be applied in drafting or revised as necessary.

[132] Adapted from S.I. No. 313/1999 – European Communities (Television Broadcasting) Regulations, 1999.

[133] This term encompasses all forms of video programming. For countries whose legal and regulatory framework uses the term "television" and "television programming", this definition can be adapted accordingly.

[134] The Accessibility Policy should be developed by the ministry/NRA responsible for broadcasting, video programming content or communications (or in countries without a ministry by the entity responsible for communication), often with significant input or even responsibility for drafting by the regulator. As discussed at www.ictregulationtoolkit.org/en/Section3259.html, the Ministry might of course be constituted in one of several ways: Broadcasting, Electronic Communications (including broadcasting and other media); or Information and Communication Technology (or communication and information technology).

[135] This clause must be adapted to reflect individual country legislative frameworks and definitions of broadcasting/content services.

2.5 At a national level, a number of policy and legislative instruments contain key provisions that support the stated goal of this policy, i.e. making television accessible for persons with disabilities. These include:

2.5.1 [Consumer Protection policy/legislation, citation, brief description]

2.5.2 [Anti-discrimination policy/ legislation, citation, brief description]

2.5.3 [Procurement policy/legislation, citation, brief description]

2.5.4 [Access to Information policy/legislation, citation, brief description]

2.5.5 [Persons with Disabilities policy/legislation, citation, brief description]

2.5.6 [Universal Service and Access policy/legislation, citation, brief description]

2.5.7 [Other policy/legislation, including that relating to an Ombudsman, citation, brief description]

3. National mandate

3.1 [Country] is a signatory to the United Nations Convention on the Rights of Persons with Disabilities ("the CRPD" or "the Convention"), which came into force in May 2008. This convention recognizes accessibility as a human right and requires signatories to adopt appropriate measures to ensure access by persons with disabilities to information and communication technology, emergency services and Internet services on an equal basis with others. Audio-visual works such as television are covered by Article 9 of the Convention which states that persons with disabilities must have equal access to others to "to information and communications, including information and communications technologies and systems..."

3.2 Television broadcasting is mentioned explicitly in article 30(1)(b) of the Convention which states that "parties recognize the right of persons with disabilities to take part on an equal basis with others in cultural life, and shall take all appropriate measures to ensure that persons with disabilities: a) enjoy access to cultural materials in accessible formats; and b) enjoy access to television programmes, films, theatre and other cultural activities, in accessible formats."

3.3 The implication of Article 30 is that metrics for television/video programming accessibility need to cover not only *awareness* of access service provision, but also *use* and *benefit*. Finally, article 9(2)(b) stipulates that State Parties to the Convention must "ensure that private entities that offer facilities and services which are open to or provided to the public take into account all aspects of accessibility for persons with disabilities". This covers private sector television broadcasters, other content providers and producers of television content.

3.4 Further to the provisions of the Convention, the [Country] constitution supports the right to equality before the law. This includes the full and equal enjoyment of all rights and freedoms. To promote the achievement of equality, legislative and other measures are designed to protect or advance persons or categories of persons disadvantaged by unfair discrimination.

3.5 Accordingly, no person may unfairly discriminate directly or indirectly against anyone on one or more grounds, including race, gender, ethnic or social origin, sexual orientation, age, disability, religion, conscience, belief, culture, language and birth[136].

3.6 Particularly important disabilities relevant for television programming include[137]:

3.6.1 Hearing disabilities;

3.6.2 Visual disabilities;

[136] In the event that a country has an existing constitution prescribing rights to equality, the policy-maker must use the country's constitution.

[137] www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2207-1-2011-PDF-E.pdf

3.6.3 Cognitive disabilities; and

3.6.4 Physical disabilities.

4. Objectives

4.1 Recognizing the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to freedom of expression, information and communication, and the role that television services play in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms[138], the following principles must be adhered to and underpin this policy:

4.1.1 Non-discrimination;

4.1.2 Full and effective participation and inclusion in society;

4.1.3 Accessibility;

4.1.4 Availability;

4.1.5 Advocacy; and

4.1.6 Affordability.

4.2 The objective of this policy is to provide an enabling framework to support the development of a culture and practice of television/video programming accessibility through:

4.2.1 Defining the general principles by which the accessibility of video programming for persons with disabilities is to be realized, including how such services should be funded;

4.2.2 Identifying and mitigating the identified leading barriers to fully accessible television/video programming by determining relevant rules, requirements, standards and funding mechanisms to address such barriers;

4.2.3 Putting in place measures to ensure that persons with disabilities have access, on an equal basis with others, to television/video programming content, services, devices, systems and applications provided to the public, irrespective of the distribution or delivery mechanism, platform or technology on which it is provided;

4.2.4 Defining an institutional framework to ensure transparent oversight and impartial dispute resolution that will strengthen the promotion of e-Accessibility.

5. Awareness and customer service

5.1 [The NRA] must take steps to ensure that the public is aware of television/video programming accessibility requirements, the measures that have been put in place to promote accessibility and their rights in terms of the relevant legislation and regulations. The [NRA] should, in promoting awareness, work with organizations representing persons with disabilities and/or the Committee on ICT Accessibility[139].

---

[138] This includes freedom of expression and access to information, media plurality, the promotion of cultural diversity, the protection of personal data and the protection of consumers.

[139] In order to mainstream television/video programming accessibility, the NRA may set up a committee on ICT or television/ video programming accessibility in furtherance of its statutory objectives to promote the interests of users, and to ensure the involvement of organizations of persons with disabilities in the development of all policies, regulations or industry codes from the outset. The committee will provide guidance, not only on disability policy and regulations, but on all policy and regulations which may impact persons with disabilities. This is discussed in greater detail in Module 1. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject

5.2 Licensed service providers are encouraged to take effective steps to publicize and create awareness of the accessibility of their television services including through periodic announcements on their own and other services, advertising accessible programmes on electronic programme guides, printed programme guides and providing information in publications aimed at persons likely to benefit from accessible television/video programming services. They must submit annual reports to [the NRA] demonstrating their compliance with this requirement.

5.3 Licensed service providers should ensure that persons with disabilities can have access to services by compiling a database of disability organizations, including organizations for different kinds of disabilities, and sending them information periodically about the services and products offered[140].

5.4 Licensed service providers should train their customer service staff how to serve customers with disabilities, including explaining how they can find information about access services on electronic programming guides (EPGs) as well as how to use and customize available access services.

5.5 Licensed service providers and NRA's should designate a single point-of-contact for information and complaints about accessibility issues. This designated point of contact should be publicized by the broadcaster, and publicity about such point of contact must be made accessible to persons with disabilities. Each complaint must be submitted to the NRA by the licensed service provider within seven days of receipt with an indication of what actions have been taken to resolve it.

5.6 Electronic programming guides (EPGs) are required to work with licensed service providers and disability groups to publicize the information and facilities available on EPGs to assist people with disabilities. This should include information targeted at mainstream publications, as well as publications used by persons with disabilities. Such information should furthermore be regularly featured prominently on EPGs.

5.7 It is critical that everyone is able to understand the internationally recognized access service icons that are used for programme information and the messages that are conveyed. Standardized or generally known and accepted language and symbols should be adopted to notify the public of channels and programmes that are accessible. Where applicable, public information on television accessibility services should use the following symbols to denote accessibility – closed captioning (CC), subtitling for the deaf and hard of hearing (SDH), signing (SL) and audio description (AD)[141]. Where relevant and feasible, information on EPGs should also be provided in audio to ensure access by people with visual disabilities. Any symbols used should be widely disseminated in public communications and should be explained in an appropriate part of the EPG[142].

6. Television/video programming access

6.1 Television/video programming, regardless of the platform on which it is delivered, is a medium which informs, educates and entertains. In light of its social and cultural role and impact on a country, it

---

to public consultation that includes persons with disabilities alongside other stakeholders such as licensed service providers, video programming vendors and ICT industry representatives.

[140] In countries where the institutional framework and budget supports it, a centralized, state funded, non-profit entity could coordinate awareness initiatives on behalf of the Ministry; the entity would furthermore act as a hub for initiatives such as building a research panel of relevant individuals who would benefit from accessible video programming.

[141] This common language/code is indicative (additional codes such as DV (descriptive video), may be used in some jurisdictions). The symbols may also vary from country to country and the text of this paragraph should be amended accordingly. Symbols to indicate accessibility should furthermore be able to be easily differentiated from other symbols that are used for classification of movies and publications such as S (sex), L (language), V (violence). The chosen symbols should be easily understood by all, and well communicated.

[142] Each country should ensure that this clause is aligned with the codes/symbols used in the respective country and in the definitions section, in particular the definition of programming Information.

must be accessible to as many people as possible. Therefore, licensed service providers are required to deliver closed captioning[143], sign language[144], and audio description[145] across specified programmes in order to ensure access by persons with disabilities[146].

6.2 The NRA can mandate the above accessibility measures through regulations, licence conditions, accessibility targets and codes of good practice, and other relevant measures[147].

6.3 The NRA will define, in regulations, licence conditions, accessibility targets or codes of good practice or other relevant measures, an implementation roadmap together with licensed service providers and organizations of persons with disabilities identifying milestones for progressive implementation of access services. Such roadmap should prioritize the implementation of access services for different types of programmes, including news, live, emergency communications and pre-recorded programmes. The targets set might differ for different categories of licensed service providers. For example, public service broadcasters may have greater responsibilities than commercial service providers, especially where they receive public funds for content development. Such targets can establish short, medium and long-term goals.

6.4 Content creators and owners are responsible for creating the content for these services and delivering that content to the licensed service provider. This policy recognizes the complexity of the video programming value chain and therefore encourages licensed service providers to promote, through their content acquisition, programming and editorial policies, the delivery of access services as part of content producers' packages.

6.5 This policy recognizes that the migration from analogue to digital television and to Internet Protocol television facilitates the provision of access services for persons with disabilities. For this reason, this policy requires licensed service providers to plan for access services as part of their migration strategy.

---

[143] See Section 7 below. There are two options for providing captions, either in "closed" or "open" format. Because open captions cannot be turned off by viewers but are always on, closed captions, which can be turned on or off, are preferred and are required where it is technically feasible. Language considerations should also be taken into consideration in establishing national policies. For example countries must consider the technical capabilities of set top boxes to support national languages. It may, initially, be necessary to allow exemptions or delay the provision of captioning in languages that are not currently supported by commercially-available set top boxes (e.g. Swahili or Urdu), while also supporting research and development of set top boxes that do support national languages. In addition, in countries with multiple languages, the NRA should organize a public consultation, including persons with disabilities and other relevant stakeholders, to agree the choice of language(s) for closed captions and signing.

[144] See Section 8 below. Countries must consider the literacy levels of deaf and hard of hearing people in establishing required access services. For example, illiterate deaf viewers will require sign language access services while literate hard of hearing viewers may prefer captions.

[145] See Section 9 below. The NRA may consider exempting audio description of music and news programmes and services, where there is little space within the dialogue/sound track to provide audio description, and less need. See, e.g. Ofcom's Code on Television Access Services, Section 21(a) at http://stakeholders.ofcom.org.uk/broadcasting/broadcast-codes/tv-access-services/code-tv-access-services-2013/ Policy makers and regulators must also ensure that set-top boxes and television devices support audio descriptions. This can be achieved through the adoption of relevant standards as provided in Section 6.6 below.

[146] Countries will identify the programmes required to provide specific access services by defining an implementation framework in line with Section 6.3 below.

[147] See Module 1, section 3 - Options for regulation.

6.6 [The NRA] must adopt standards, including international standards[148] where available, to ensure the interoperability of television services and equipment enabling users to receive, decode and display access services for persons with disabilities, and to mandate the use of such standards [149] Organisations representing persons with disabilities, licensed service providers and equipment manufacturers/distributors should be consulted in determining any equipment standards.

7. Captioning

7.1 Licensed service providers are required to deliver closed captions where technically feasible because they allow viewers to choose when to use them. The use of closed captions is facilitated by digital television platforms. "Open" captions may be used until the migration from analogue to digital television.

7.2 [Open or] closed captions must be provided in at least one official language. Captioning must be in the language of the audio portion of the programme and carry sound representations[150] [151].

7.3 The [NRA] should determine through consultation with all stakeholders, including organizations representing persons with disabilities, the minimum levels of quality or maximum error rates for such captioning to assure comprehensibility and synchronization with the video portion of a programme in line with section 10 below[152].

---

[148] Policy-makers, legislators and regulators need to have an understanding of the family of television standards that has been adopted in their region or country (DVB in Europe and most of Africa, ATSC in North America and in South Korea, ISDB in Japan and much of South America, and CMMB in the People's Republic of China). Digital television standards usually have provisions for captioning and audio description. For this reason, it makes economic sense to start with the features that already are present in digital television receivers rather than risking national and regional market fragmentation leading to higher production and receiver costs.

[149] Noting the need for such standards since currently commercially-available set-top boxes do not support certain languages. The European Platform of Regulatory Authorities (EPRA) has identified seven European countries that have adopted technical standards to ensure set-top boxes support access services and cited a formal EU Convergence Green Paper process that contemplates the adoption of an additional standard forming part of the European Standard covering all audiovisual issues related to accessibility.

See http://epra3-production.s3.amazonaws.com/attachments/files/2202/original/accessibility_WG3_final_revised.pdf?1373379195

[150] Sound representations indicate the non-dialogue portion of the sound track (e.g. doorbell rings). Subtitles without sound representations are used to provide translations into foreign languages and are not related to accessibility for persons with disabilities.

[151] Where channels are dedicated to a particular language, captioning should be provided in the language of the channel.

[152] Choices related to the provision of captions and signing should be informed by literacy levels of deaf and hard of hearing populations in a country since captions can only be used by people who are literate.

8. Signing

8.1 The [NRA] should develop specific requirements for licensed service providers to deliver signing in consultation with all stakeholders, including organizations representing people who are deaf[153] recognizing that sign language requirements are important to provide access to deaf populations, especially to people who were born deaf and for whom sign language is their first or only language. This has serious implications for news and emergency communications[154].

8.2 Where signing is provided, licensed service providers should be encouraged to provide it in a manner that the viewer can see not only the hands but also, where applicable, the facial expressions of the signer.

8.3 Licensed service providers should monitor the effectiveness of the service through regular contact with organizations representing people who are deaf.

9. Audio description and audio subtitles

9.1 Licensed service providers are required to make video programming accessible for viewers who are blind or have low vision through the provision of audio description in the official language(s) of the country because blind and low visions users of television/video programmes rely on audio description to understand the visual content of the programme.

9.2 The language of the audio description should be the same as the programme audio.

9.3 Foreign language television programmes, in countries that use subtitling in national languages[155], should be made accessible through the provision of audio subtitles[156] for viewers who are blind or have low vision, as well as for individuals with cognitive impairments or those who have a low reading speed[157]. Viewers who are blind or have low vision will require both audio description and audio subtitles to access foreign language television programmes subtitled in national languages.

9.4 Licensed service providers who create video programming are responsible for ensuring that producers, editors and presenters are trained in techniques to describe the significance of images for the benefit of the blind and partially-sighted audience and to provide to [the NRA] an annual statement of the training they are providing[158].

---

[153] In bi- or multilingual countries, the choice of signing language and its implementation are particularly important and should be a topic of public consultation.

[154] Countries may consider 'open' or 'closed' signing and revise this Section to specify which one is required, Examples of closed signing solutions include the provision of a separate virtual sign language channel (Denmark), delivery of a TV programme with sign language via the Internet (and then displayed on the TV set) or the use of an integrated broadcast broadband receiver (e.g. Hbb TV in Europe; Hybridcast in Japan) to offer the viewer a television service where the signal is delivered via broadband to the TV set). For additional information see update from e-Access+ on open and closed signing at http://hub.eaccessplus.eu/wiki/Accessible_Digital_Television_for_the_Hearing_Impaired.

[155] This section does not apply to countries that dub in national languages.

[156] This section applies only to subtitling countries. Audio subtitles are delivered using the same mechanisms as audio description. Because audio subtitles are also used by people with reading difficulties, including the aged, people who are dyslexic and immigrants, the country should also consider literacy levels in a national language before confirming the approach to be taken.

[157] This service was introduced in the Netherlands in 2002, and is found today in Belgium, Denmark, Finland, Norway and Sweden. It is relatively inexpensive to set up and has negligible running costs.

[158] See Ofcom's Code on Television Access at http://stakeholders.ofcom.org.uk/broadcasting/broadcast-codes/tv-access-services/code-tv-access-services-2013/

10. Quality of service

10.1 Persons with disabilities have specific quality of service requirements for television/video programming accessibility.

10.2 The [NRA] should determine through consultation with stakeholders, including organizations of persons with disabilities, specific minimum quality requirements for audio description, [audio subtitles where relevant], closed captions and signing, as well as metrics to measure the level of performance.

10.3 Quality of service standards may include as a minimum the following requirements:

10.3.1 Standards to ensure that captions are readable, accurate and comprehensible so that they are meaningful to audiences. This will include specifications on font type, font size, contrast and use of colours to facilitate access by persons with low vision, and requirements on ensuring viewer control over these.

10.3.2 Quality of service standards establishing maximum error rates and standards to ensure synchronization between closed captions and dialogue;

10.3.3 Quality of service standards relating to placement and clarity of audio descriptions;

11. Equipment

11.1 This policy recognises that the equipment a person uses to watch television depends on the transmission medium. For cable, satellite or terrestrial television, the equipment consists of a television, sometimes a separate receiver in the form of a 'set-top box', and a remote control. For Internet or mobile television, the equipment is a PC or handheld device running a software application or accessing a website. Regardless of how a person accesses television, they must use a mix of hardware (screens, buttons, cables, remote controls etc.) and software (menus, programme guides, pause/rewind/record functions etc.).

11.2 End-user television equipment must support access services[159]. Policy-makers should find ways to encourage retailers of television remote controls to ensure that all such equipment and software that is sold to the public is compliant with applicable universal design standards and considers the needs of persons with disabilities[160]. While retailers and manufacturers of television equipment are not regulated, policy-makers should require that such considerations are taken into account when setting standards for equipment in line with section 6.6 above or require the [NRA] to take into account television accessibility standards should they be responsible for type approval of any television related equipment.

11.3 End-user television equipment can also sometimes be very difficult to use for people with sensory and physical disabilities, as such:

11.3.1 Policy-makers should ensure that these considerations are taken into account in adopting standards (see section 6.6) or if any subsidies or other assistance is provided for equipment[161].

---

[159] This requirement can be achieved by the NRA adopting technical standards for interoperable television services and equipment to enable users to receive, decode and display access services for persons with disabilities and by mandating the use of such standards as provided in section 6.6 of this model.

[160] Television broadcasting requires the user to use a mix of hardware (screens, buttons, cables etc.) as well as software (menus, program guides, pause/rewind/record functions, etc.). People with sensory and physical disabilities may find it difficult to use this equipment. The difficulties range from an inability to see labels on remote controls, to reading on-screen text for example. Accordingly, remote controls with larger and coloured buttons or the ability to increase the size of on-screen text, change its colour, or have it spoken out in a synthetic voice may be required. See ITU-G3ict e-Accessibility Toolkit at www.e-accessibilitytoolkit.org/.

[161] Some countries have, for example, provided subsidies for defined categories of people to purchase set-top boxes or to cover the costs of their installation to promote the migration from analogue to digital terrestrial television.

11.3.2 Licensed service providers and manufacturers of consumer television equipment must ensure that viewers who are deaf or hard-of-hearing who use hearing aids, will be able to hear the programme aided by the use of *wireless connections* between the television receiver and the hearing aid itself, or, wired connections between the TV receiver and an assistive listening device of the viewer's choice.

12. Electronic programme guides

12.1 This section applies to electronic program guides (EPGs), digital video recorder options and video on demand options.

12.2 The [NRA] should incorporate into any code of good practice for electronic programming guides or relevant regulations or licence conditions, requirements that EPG providers indicate which programmes are accompanied by access services using internationally recognized access service icons; provide user information to persons with disabilities; and ensure that EPGs are accessible to users with sensory impairments, including the blind and visually-impaired[162]. This includes the following requirements:

12.2.1 Where applicable, licensed service providers should ensure that the programme synopsis in the EPG indicates which programmes are accompanied by access services, using the following internationally recognized access service icons – closed captioning (CC), subtitling for the deaf and hard of hearing (SDH), signing (SL) and audio description (AD)[163]. Where practicable, these abbreviations should be explained in an appropriate part of the EPG. If non-standard terms are used in any part of the EPG, and removal or replacement by the standard abbreviations would require software or hardware updates, this should be done at the next reasonable opportunity.

12.2.2 Licensed service providers should ensure they provide accurate and timely information to EPG and other TV programme listing providers about television access services. Licensed service providers should include in programme synopses provided to such providers information about which programmes include access services[164].

12.2.3 Licensed service providers should ensure EPGs provide information about assistance in relation to programmes (e.g. how to navigate programme listings, and how to operate television access services such as closed captioning, signing and audio description), as well as facilities for making use of that assistance[165].

12.2.4 Licensed service providers should provide on an easily accessible part of the EPG (where practicable) or alternatively in other accessible ways (e.g. on websites or interactive services) information[166] for persons with disabilities on:

12.2.4.1 How to use the EPG;

12.2.4.2 How to use the access services accompanying the programmes;

---

[162] The European Platform of Regulatory Authorities (EPRA) identified a voluntary collaborative initiative between a private company (Goodman) and the Royal National Institute of the Blind (RNIB) to develop the Smart Talk set top box which enables programme information from the EPG to be spoken aloud.

See http://epra3-production.s3.amazonaws.com/attachments/files/2202/original/accessibility_WG3_final_revised.pdf?1373379195.

[163] The symbols should be amended to reflect those used in a particular country. See section 5 of this module.

[164] Some NRA's may be empowered by law to develop codes for EPG providers. Where so mandated, NRAs should set similar requirements for such providers in the relevant code.

[165] This information may be made available via their websites in countries with significant Internet penetration.

[166] Licensed service providers are also required to train their customer staff to assist persons with disabilities. See Section 5.4 of this module.

12.2.4.3 What options exist for customizing the appearance of the EPG to make it easier to use; and

12.2.4.4 What additional sources of help and information are available in other places (e.g. on websites, or from telephone / text phone helplines), whether from the EPG provider, or Licensed service provider.

13. Emergency services

13.1 Public awareness about the availability of accessible emergency services for persons with disabilities is mandatory. It is the responsibility of the NRA, licensed service providers and public bodies with responsibility for emergency services to create awareness about the availability and accessibility of emergency services by persons with disabilities.

13.2 Emergency information made available to the public should also be provided in formats accessible to persons with disabilities such as sign language and subtitles for the deaf and hard of hearing and audio messages for those with visual disabilities on television/video programming.

13.3 Public communications and announcements in natural disaster situations must be made accessible to persons with disabilities in appropriate forms of communication to leverage mainstream communication channels. Licensed service providers must ensure that such announcements and alerts are broadcast in relevant formats accessible to all persons with disabilities.

14. Funding

14.1 Government must ensure that public television broadcasters have adequate funding to provide a high quality service to meet the needs of persons with disabilities.

14.2 Funding and education, offered via the universal service and access fund[167], public broadcasters' budgets or any other funding mechanism or scheme[168], may be necessary to provide assistance for:

14.2.1 Formal help schemes to switch from analogue to digital television for the elderly, who may have difficulties such as bending down to adjust televisions, and persons with disabilities, which may include the provision of assistance in installing equipment, re-scanning[169], providing advice and practical tips where needed in using equipment, including the functioning of remote control devices and captioning functions;

---

[167] Only applicable in countries where the fund is converged and can thus be used to subsidize video programming, services and equipment. See Module 1, section 5.

[168] Other funds that can be used to promote accessible programming include production or cultural industry promotion funds. Ideally such funds would only be used for accessible content production. An example of this type of fund would be the Broadcasting Accessibility Fund established in Canada by the Canadian Radio-television and Telecommunications Commission Broadcasting Regulatory Policy (CRTC 2012-430). This fund is expected to:

- act as an independent and impartial funding body to support and fund innovative projects that provide platform-neutral solutions to promote accessibility of all broadcasting content in Canada;
- fund projects which provide practical solutions that tangibly increase accessibility in broadcasting as quickly as possible and which, whenever possible, make use of inclusive design principles to promote accessibility at the earliest stages and in the most cost-effective manner for new technologies and applications in Canada;
- retain an independent funding officer who shall be responsible for the day-to-day operations of the Corporation subject to the overriding authority of the board of directors of the Corporation.

[169] Scanning searches for and "remembers" the available digital broadcast channels. A procedure, sometimes called "double rescanning" can clear the memory of saved channels on a digital converter box because earlier scans may have saved channel information that is incorrect.

14.2.2 Making video programmes accessible that are not otherwise required in terms of this policy to be made accessible;

14.2.3 Providing accessible set top boxes to persons with disabilities to facilitate digital migration; and

14.2.4 Any other matter that will improve the affordability of access for persons with disabilities.

15. Exemptions

15.1 Licensed service providers achieving an average audience share of all households over a 12 month period of less than [1%] are excluded from providing the accessible services set out in this policy. [NRA] would expect such licensed service providers to use the policy as guidance and comply on a voluntary basis and will review exemptions annually[170].

15.2 [NRA] will prepare regulations setting out the criteria for targets and exemptions[171].

15.3 [NRA] will elaborate commitments regarding provision of accessibility services and features on broadcaster on-line programming (on the Internet) such as video-on-demand and catch-up services.

16. Representation and portrayal of persons with disabilities[172]

16.1 [The NRA] should if necessary determine guidelines or otherwise promote and advance that co- or self-regulatory editorial ethics/standards include standards promoting fair and equitable representation and portrayal of people with disabilities by licensed service providers and other content providers in their programming.

16.2 Such editorial codes should further explicitly specify that any clauses dealing with protecting audiences from discrimination or harmful or offensive content should explicitly include protection of persons with disabilities. Licensed service providers should be encouraged to expand on such policies in their own codes and guidelines for producers and content providers.

16.3 Such codes/editorial standards should be developed in consultation with a wide range of stakeholders, including organizations of persons with disabilities. [The NRA] should, in any requirements it sets on development of such a Code, ensure that such consultation is mandatory.

16.4 Licensed service providers should further be required to create awareness of the Code and its provisions by regularly including information on the Code in all their publicity material. Such publicity

---

[170] Countries may wish to have a minimum compliance threshold, or may decide not to have any exemptions at all. Where there is provision made for exemptions, the threshold percentage that is set will depend on the country's population and audience size. This provision seeks to exclude stations with small audience which may have to incur relatively high expenses to comply with the requirements. In some instances, those exempted may be required to contribute funding to an agency set up to promote television access services. For example, in the UK low audience channels are not required to include sign language in programming, but are required to contribute funds to a trust established to commission programming that includes accessibility features.

[171] The criteria used by Ofcom and the FCC for example takes technology, market and programing factors into account including; the nature of the services (public broadcasting services (PBS) versus private); market share; platform (digital versus analogue); programme format/ genre; technical capacity; and impact on the operations of the service provider.

[172] Inclusion of this clause will depend on the broad legislative and policy framework in place in individual countries. In some countries (such as the US) the NRA does not get involved at all in editorial content guidelines or standards due to constitutional protections. In many others, however, the NRA has some oversight of co-regulatory or self-regulatory editorial standards or codes (such as in Canada where the CRTC approves of codes developed and enforced by industry bodies). In still others (such as South Africa), the NRA is required to develop such an editorial code and related regulatory policies which then apply to any licensees that do not subscribe to a self-regulatory body.

material should be accessible to people with a range of different disabilities to ensure widespread awareness of its provisions. Publicity material should include regular public service announcements about the Code as well as information on how to complain about alleged breaches of provisions.

16.5 Licensed service providers should be required to provide annual reports to the [NRA] on all complaints received about the Code and how these had been resolved.

16.6 The NRA, or other body responsible for research, should conduct regular research on representation and portrayal of people with disabilities in video programming.

17. Targets and reporting requirements

17.1 NRAs should establish, in consultation with persons with disabilities, licensed service providers of video programming and other relevant stakeholders (in line with Module 1, sections 6 and 8), annual measurable targets to be implemented by licensed service providers, issue an annual public report on implementation and compliance with this policy[173] and take necessary enforcement action when appropriate.

17.2 Sample measurable targets include:

- Percentage of video programming, by type of programme, that offers different access services, including closed captioning, signing and audio description;
- Licensed service providers take effective steps to publicize and create awareness of the accessibility of their television/video programming services;
- EPGs use internationally recognized icons to indicate type of access service provided;
- Emergency broadcasts are all in accessible formats;
- Quality of service standards for accuracy and synchronization of closed captioning and audio description established.

17.3 In addition, milestones should be set to measure progress in implementing the policy and any related codes of conduct, regulations and licence conditions, capacity to implement the policy, codes of conduct, regulations and licence conditions (e.g. establishing necessary budgets and training programmes) and progress in availability of accessible television/video programming for persons with disabilities.

17.4 Access to information about television/video programming accessibility for the disability community is critical to ensuring that future reviews of accessibility policy measures are effective and that policy interventions are evidence-based. To achieve this, the NRA should determine reporting requirements for notifying the disability community about the accessibility requirements contained in the policy and related codes of conduct, regulations and licence conditions. A thorough review should be conducted by NRAs of *all* reporting requirements to ensure that the correct data is collected with respect to accessibility for persons with disabilities, at the right level of detail and at reasonable intervals[174].

18. Periodic review

18.1 Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

---

[173] Where a committee on ICT or television/video programming has been established, the annual report will be reviewed by the committee. See Section 5.1 of this model.

[174] Reporting requirements may need to be changed in regulations, depending on whether the ICT law has a specific section on reporting.

Annex: Sample regulations[175]

U.S. Federal Communications Commission: Video Description Orders, Public Notices, Notices, Press Releases and Factsheet

Summary: Fact sheets, reports and regulations from a 2000 FCC rulemaking, reversed in 2002, requiring U.S. broadcasters to describe 4 hours of programming per week.

Reference: www.fcc.gov/cgb/dro/video-description.html

House of Representatives (USA): H.R.6320 21st Century Communications and Video Accessibility Act 2008

Summary: Proposed U.S. legislation mandating accessible IPTV and Internet content (captions, descriptions), and accessible menu guides and user interfaces. Reinstates overturned TV description requirements.

Reference: www.coataccess.org/node/32

Canadian-Radio Television and Telecommunications Commission (CRTC): Broadcasting Public Notice: CRTC 2007-101

Summary: Canadian requirements for television programme distributors (broadcast, cable, satellite) to carry video description in their signals and ensure pass through to the consumer.

Reference: www.crtc.gc.ca/eng/archive/2007/pb2007-54.htm

Canadian Radio and Television Commission (CRTC): Access to TV for persons with visual impairments

Summary: Synopsis of what description is, who uses it, Canadian description providers and links to regulations.

Reference: www.crtc.gc.ca/ENG/INFO_SHT/b322.htm

Office of Communications (OFCOM): Code on Television Access Services

Summary: The Code sets out requirements on subtitling, sign language and audio description that apply to television services. It includes increasing targets over a ten year period.

Reference: http://stakeholders.ofcom.org.uk/broadcasting/broadcast-codes/tv-access-services/code-tv-access-services-2013/

Australian Communications and Media Authority (ACMA): Broadcasting Services (Television Captioning) Standard 2013

Summary: The Standard sets out mandatory standards related to captioning on television services. It sets standards to ensure readability of captions (positioning, font, colour etc.), accurate, and comprehensible (for example, clearly identify different speakers including off screen voices).

Reference:
www.acma.gov.au/~/media/Broadcasting%20Investigations/Issue%20for%20comment/pdf/Broadcasting%20Services%20Television%20Captioning%20Standard%202013.pdf

[175] Source E-Accessibility Toolkit, see www.e-accessibilitytoolkit.org/toolkit/technology_areas/television#regulations

Module 5: Web accessibility policy framework

The Model web accessibility policy has been developed for policy-makers, regulators, other government entities active in development of government web and e-governance policies and/or in promoting accessibility of government services and other stakeholders, including non-governmental organizations (NGOs), organizations of persons with disabilities and parliamentarians depending on country specifics.

It provides a framework for countries to put in place a policy to ensure all online government information and services (including, for example, webpages, website applications and websites) are accessible to persons with disabilities. This includes external (public-facing or private) and internal (closed community) sites.

The Model web accessibility policy has been prepared pursuant to the United Nations Convention on the Rights of persons with disabilities (the Convention), and in line with the International Telecommunication Union (ITU) and G3ict ICT Accessibility Policy Toolkit for persons with disabilities (www.e-accessibilitytoolkit.org). The Convention provides that signatories are responsible for ensuring ICT accessibility; and this model policy is designed to assist signatory countries develop a policy framework to achieve this. Countries can adopt these policy and regulatory provisions even if they are not signatories to the Convention.

Successful achievement of the goals set out in the Convention relies on the adoption and early implementation of web accessibility policies by a country. Each country has to decide on the respective policies and the timing for their implementation in accordance with its unique circumstances. This Model web accessibility policy will assist countries to understand the generic steps and requirements and provides guidance in areas where existing policies can be amended or new policies developed to meet national circumstances.

The goal of any web accessibility policy is to remove barriers persons with disabilities face in using websites. For example, people who are blind or with low vision require websites that are compatible with screen readers that read text aloud; provide text alternatives for images which describe images; allow for resizing of text, images and page layouts and provide alternative web navigation aids. People who are deaf or hard of hearing will require captions for any content that is spoken, including videos, media players and web applications (apps). People with mobility disabilities may require additional time to complete tasks on a website and streamlined and keyboard-only compatible navigation mechanisms and page functions allowing use of alternative input devices[176].

Web policies can be implemented by one coordinating governmental body, such as ministries of communication and information technology[177], as part of e-governance measures. Alternatively, sector-specific ministries may adopt web accessibility policies for all websites under their responsibility. For example, ministries of education may implement web accessibility policies for national universities and ministries of finance for all customs and tax-related websites. Further, countries may decide to adopt stand-alone web accessibility policies or incorporate such policies into general government website guidelines. This Model web accessibility policy is designed to be sufficiently flexible to be used by a range of government stakeholders and institutional frameworks.

The goal of this model policy is to assist countries to create a policy framework which promotes government web accessibility for persons with disabilities by taking the following steps:

- Adopting a web accessibility policy, either as a stand-alone document or integrated into an existing policy;
- Consulting with persons with disabilities on the development of a web accessibility policy;

[176] See www.w3.org/WAI/intro/people-use-web/diversity.html for more information on the accessibility needs of different kinds of web users.

[177] India is an example of a country whose web accessibility policy is incorporated into national guidelines for websites as part of India's e-governance measures under the responsibility of the Department of Information Technology of the Ministry of Communications and Information Technology.

- Making persons with disabilities and organizations of persons with disabilities aware of this policy and accessible government websites;
- Identification of the responsible authority who will monitor and ensure implementation of this web accessibility policy;
- Ensuring government websites comply with international web accessibility standards;
- Identifying all government websites and assessing all websites covered by the policy;
- Government agencies updating their procurement policies to ensure all website development service contracts require accessible websites;
- Providing training to web developers on web accessibility;
- Providing guidance on accessibility testing tools and procedures;
- Making government websites accessible for persons with different kinds of disabilities;
- Monitoring and publishing reports on progress achieved in government website accessibility
- Encouraging private entities that offer website services, applications, and content to the public to take into account on a voluntary basis all aspects of accessibility for persons with disabilities; and
- Providing guidance and incentives for education institutions and professional societies to develop courses for computer science students and information technology professionals about web accessibility.

Because of the rapid advances in technological developments, countries are encouraged to adopt processes to conduct periodic reviews of the policy once passed, to best harness these technological opportunities.

National web accessibility policies: Institutional and legislative frameworks

Countries need to decide where a web accessibility policy would be situated in their institutional, policy and legislative framework.

Where legislation on web accessibility has been put in place, there is considerable variation in the sectorial context and type of legislative instrument utilized in different countries.

Options for countries include:

(a) Making reference to web accessibility in the framework of specific legislation, e.g. in one or more of the following: ICT, e-Government, public procurement, health, education and/or other sector-specific legislation;

(b) Addressing web accessibility, explicitly or implicitly, in the framework of anti-discrimination and equality legislation that is directed towards equitable access to goods and services by persons with disabilities in more general terms. This approach can provide persons with disabilities, individually or collectively, with the right to seek redress if a public service provided over the Internet is not accessible to them.

National web accessibility policies: National standards vs. international standards

The approach taken by this model policy is to apply current versions of the most authoritative international standards to avoid "regulatory lag" as well as potential problems for industry and consumers if any particular country were to put in place distinctive, non-harmonized requirements for web accessibility. This is because development of specific regulatory standards for web access might first require amendment of the country's Disability Discrimination Act or its ICT Act to widen its scope and provide the authority to establish "disability standards." Should the ICT Act be amended, for example, the time required for other standards development processes under the ICT Act and the institutional framework which generally

involves a national bureau of standards designed to address equipment type approval, would present challenges for regulating the Internet – a fast changing area.

Regarding international standards, the present policy refers to WCAG 2.0 and to its equivalent ISO/IEC 40500:2012. From a practical standpoint, while the ISO reference is essential to align international and national standards, referencing WCAG 2.0 will allow government agencies to integrate the latest developments occurring in the field of web accessibility in a fast changing technology environment.

Model web accessibility policy

1. *Definitions*

- **"Electronic document"** refers to downloadable files which may be consulted, printed or filled off-line or on-line by users.
- **"Level A"** refers to the minimum level of conformance that a website must satisfy in terms of the WCAG guidelines, or a Level A conforming alternate version is provided.
- **"Level AA"** refers to the intermediate level of conformance that a website must satisfy having met all of the Level A and Level AA success criteria in terms of the WCAG guidelines, or a Level AA conforming alternate version is provided.
- **"Level AAA"** refers to the highest level of conformance that a website may satisfy having met all of the Level A, Level AA and Level AAA success criteria in terms of the WCAG guidelines, or a Level AAA conforming alternate version is provided[178].
- **"Public sector"** refers to ministries, national government departments, local government and other government or public agencies that provide e-government services and communication to the public as well as public education resources via websites, email, SMS and other means of electronic communications[179].
- **"Website"** refers to the entire collection of electronic files that are accessible through a domain name. It includes all website home pages and pages (including web applications and services, and dynamically-generated content) referenced from website home pages, and web applications accessible from such webpages.
- **"Web Content Accessibility Guidelines 2.0" or "WCAG 2.0"** refers to the web standard developed by the World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI)[180].

2. *Preamble*

2.1 Web accessibility is critical for all members of society, including persons with disabilities. Accessibility issues related to the Internet and web content and services affect a wide range of persons with disabilities, including people with auditory, cognitive, dexterity, hearing, speech and visual impairments.

2.2 Accessing and making use of the web can be achieved for persons with disabilities through the application of accessible web standards, applied from the earliest stage of design, through the development of websites and continuing as webpages are maintained and enhanced.

2.3 The objective of this policy is to enable persons with disabilities to navigate and interact with the web. This is an important imperative of national universal service and access policies which seek to increase usage and uptake of ICTs, and of broadband in particular, regardless of device (desktop, mobile, tablet, etc.) and to ensure digital inclusion of all population groups.

---

[178] Note: ISO/IEC 40500:2012 does not recommended that Level AAA conformance be required as a general policy for an entire site because it is not possible to satisfy all Level AAA success criteria for some content.

[179] The regulatory authority should list all government organizations to which this is applicable or use a reference in legislation if there is applicable public services legislation.

[180] This standard is available at www.w3.org/TR/WCAG20/ and introduced at www.w3.org/WAI/intro/wcag. This standard is also referenced as ISO/IEC 40500:2012 Web Content Accessibility Guidelines 2.0, available at: www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=58625.

2.4 This policy is underpinned by the four principles of ICT accessibility for persons with disabilities reflected in W3C/WAI Web Content Accessibility Guidelines 2.0 (also ISO/IEC 40500:2012):

(a) **Perceivable** – *Information and user interface components must be presented to users in ways they can perceive*. This means that the information and interface must enable users to perceive the information being presented (it can't be invisible to all of their senses);

(b) **Operable** – *User interface components and navigation must be operable.* This means that all the components of the interface can be operated by the user (the interface cannot require interaction that a user cannot perform);

(c) **Understandable** – *Information and the operation of the user interface must be understandable*. This means that the interface is presented in a way which allows the user to understand the information as well as the operation of the user interface (the content or operation cannot be beyond their understanding); and

(d) **Robust** – *Content must be robust enough that it can be interpreted reliably by a wide variety of users, including assistive technologies*. This means that users must be able to access the content as technologies advance (as technologies and user agents evolve, the content should remain accessible).

2.5 WCAG 2.0 (ISO/IEC 40500:2012) has twelve guidelines that are organized under these four principles. For each guideline, there are testable success criteria, which are at three levels: A, AA, and AAA. Levels A & AA are applicable to all websites, but many level AAA success criteria are not applicable or suitable for a large number of websites, including many that are provided by the government. These success criteria are the basis for determining conformance to WCAG 2.0 (ISO/IEC 40500:2012). The success criteria apply broadly to different web technologies (e. g., HTML, CSS, JavaScript, etc.) and there are multiple ways for websites to conform to WCAG 2.0. However, the public sector must ensure that each webpage of their websites meets WCAG 2.0 (ISO/IEC 40500:2012) conformance requirements[181].

3. Effective date and application

3.1 This policy may be cited as the "information and communications technology web accessibility policy" or "web accessibility policy", and shall come into effect upon publication in the [official government publication].

3.2 The web accessibility policy applies to public services information and communications technologies (ICTs) and in so doing applies to public sector websites[182] and electronic documents made available to the public by public sector websites[183].

3.3 This policy therefore is applicable to all webpages, web site applications, and websites containing or providing access to online government information and services under the authority of [the responsible authority][184]. Conformance is required on all government websites under the authority

[181] Australia Web Accessibility Transition Strategy: www.finance.gov.au/publications/wcag-2-implementation/index.html

[182] This could be adapted for sector-specific web accessibility policies by replacing "public sector" with "[health] [education] [or other sectors] as appropriate.

[183] WCAG 2.0 is not applicable to electronic documents – See section 11 for a definition of document accessibility.

[184] In line with the goal of ensuring that this Policy can be adapted by a range of entities depending on a country's legal and regulatory framework, as explained in the Introduction, the name of the "responsible authority" appears in square brackets to be identified as appropriate. Likewise a range of options are provided to identify the entity responsible for operating websites. Note that WCAG 2.0 is applicable to mobile web browsing: see www.w3.org/WAI/mobile/. While the accessibility of mobile applications residing on mobile devices is not covered by a specific standard the same principles used in WCAG 2.0

of [the responsible authority] [or operated by [government]/sector ministry], [local government], or [public entities]] as well as those operated on behalf of [government/sector ministry] by non-governmental entities under any domain. This includes external (public-facing or private) and internal (closed community) sites. That is, conformance is required for all Internet, intranet and extranet sites.

3.4 This policy also requires the [responsible authority] to promote among associated agencies and private sector entities the adoption on a voluntary basis of WCAG 2.0 (ISO/IEC 40500:2012) via awareness raising and training programmes in cooperation with professional associations, standard organizations and business organizations. Such voluntary programmes should promote conformance similar to that covered in this policy among private sector web sites.

3.5 [Insert relevant provision of legislation] provides that the [responsible authority[185]] is the body responsible to monitor and promote the effective use of Information Technology (IT) and specifically to support the delivery of e-Government services to citizens, including access by persons with disabilities to web content[186].

3.6 [The responsible authority] may review, update and/or amend this policy regularly based on the lessons learned from its initial implementation, the evolution of standards, the availability of new technology and web accessibility solutions and the development of accessibility skills among IT professionals. At a minimum, this policy will be reviewed every five years and updated as needed.

4. National mandate for web accessibility

4.1 [Country] is a signatory to The United Nations Convention on the Rights of Persons with Disabilities ("UNCRPD" or "the Convention"), which came into force in May 2008[187]. This convention recognizes accessibility as a condition for persons with disabilities to fully enjoy all human rights and

---

and listed in paragraph. 2.4 should be applied to downloadable mobile applications made available by government to the public: users with disabilities should be able to perceive, understand and act upon the information whether it is retrieved by the mobile app via the Internet from a government server or using data generated by the device; and the mobile app should be robust. This can be best achieved by fully leveraging the embedded accessibility features of leading mobile operating systems.

[185] The "responsible authority" will depend on the country's legal and institutional framework. There are a number of options including that the Web accessibility policy be developed by the ministry responsible for communications, for e-government and/or the ministry responsible for public service and administration (or in countries without such ministries by the entity responsible for communications), with significant input or even responsibility by an implementing agency such as a state IT agency or other agency where all national IT matters are dealt with or an agency with responsibilities for accessibility such as the agency responsible for disability or anti-discrimination laws. Centralization makes it easier for the country to coordinate with international standards organizations including W3C and ISO and to avoid legislative or regulatory inconsistencies – for instance how access to archives is treated. Alternatively, each sector ministry may be responsible for the accessibility of websites under its responsibility, such as health ministries and education ministries. In this case, a country may have several Web accessibility policies in place (and not a national policy), each overseen by a specific ministry. The "responsible authority" will impact the manner in which the Web accessibility policy is published, its legal standing and its enforceability.

[186] This provision must be modified to fit each country's legal and institutional framework. The ideal approach is the centralization of the function and for countries to have a lead Ministry/agency leading the process and supporting all government agencies. The governments of Australia and South Korea have put in place an effective approach to web accessibility for e-government across all agencies, led by a single coordination team. However, where a sector ministry is the "responsible authority", the provision could be modified to read: "[Insert relevant provision of legislation] provides that the [responsible authority] is the body responsible to monitor and promote the effective use of government-provided [e-Education] [e-Health] [other] services to all citizens, including access by persons with disabilities to web content.

[187] Where the country is not a CRPD signatory the country can use its Constitution or consumer protection, anti-discrimination, procurement, access to information, universal service and access or other relevant legislation (or a combination thereof) as the basis for the mandate as provided in the following sections.

fundamental freedoms and requires signatories to adopt appropriate measures for access by persons with disabilities to information and communication technology, emergency services and Internet services on an equal basis with others[188]. Thus the obligation exists to ensure that all public websites are fully accessible to all citizens. This includes:

4.1.1 "Providing information intended for the general public to persons with disabilities in accessible formats and technologies appropriate to different kinds of disabilities in a timely manner and without additional cost" as set out in Article 21 (a);

4.1.2 "Accepting and facilitating the use of sign language, Braille, augmentative and alternative communication, and all other accessible means, modes and formats of communication of their choice by persons with disabilities in official interactions" as stipulated in Article 21 (b);

4.1.3 "Promot(ing) access for persons with disabilities to new information and communications technologies and systems, including the Internet" as stipulated in Article 9.2 (g);

4.1.4 "Promot(ing) the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost" as stipulated in Article 9.2 (h); and

4.1.5 "Ensur(ing) that private entities that offer facilities and services which are open or provided to the public take into account all aspects of accessibility for persons with disabilities" as stipulated in Article 9.2 (b).

4.2 This Policy is designed to achieve a progressive implementation of the above dispositions of the Convention on the Rights of Persons with Disabilities as per paragraph 2 of Article 4 on General Obligations.

4.3 The [Country] Constitution supports the right to equality before the law. This includes the full and equal enjoyment of all rights and freedoms. To promote the achievement of equality, legislative, and other measures designed to protect or advance persons or categories of persons disadvantaged by unfair discrimination may be taken[189].

4.4 A number of policy and legislative instruments contain key provisions that support the stated goal of this policy which is making websites accessible for persons with disabilities. These include[190]:

- [Consumer Protection policy/legislation, citation, brief description]
- [Anti-discrimination policy/ legislation, citation, brief description]
- [Procurement policy/legislation, citation, brief description]
- [Access to Information policy/legislation, citation, brief description]
- [Persons with Disabilities policy/legislation, citation, brief description]
- [Other policy/legislation, including sector specific policy/legislation], citation, brief description]

5. Objectives of the web accessibility policy

5.1 The intent of this policy is to provide effective communication via the web to ensure persons with disabilities have access to information on an equal basis with others, through:

---

[188] As defined in Article 9, CRPD

[189] This clause relating to the Constitution is only to be included if applicable.

[190] Insert / include as applicable.

5.1.1 Putting in place mandatory measures to ensure that persons with disabilities have access, on an equal basis with others, to public sector websites, services, applications and content;

5.1.2 Encouraging private entities that offer website services, applications, and content to the public to take into account on a voluntary basis all aspects of accessibility for persons with disabilities[191];

5.1.3 Defining an institutional and administrative framework to ensure effective coordination with international standard development organizations to promote web accessibility standards among all relevant stakeholders;

5.1.4 Providing guidance and incentives for education institutions and professional societies[192] to develop courses for computer science students and information technology professionals about web accessibility.

6. Awareness

6.1 Awareness of this policy and the rights of persons with disabilities in the ICT sector is the responsibility of the [responsible authority], which must, amongst others, include a review and report on its achievements in terms of this policy annually, including in review meetings with persons with disabilities[193].

6.2 The [responsible authority] is responsible for spreading awareness of web accessibility tools available for Persons with Disabilities and the benefits of accessible ICTs for persons with disabilities and the rest of society in cooperation with relevant stakeholders from the private sector, academia and organizations of persons with disabilities. The information that is made available to the public should be provided in accessible formats (see Module 1, Box 2).

7. Compliance of public sector websites with web accessibility standards

7.1 The standard to be applied for this policy shall be WCAG 2.0 (ISO/IEC 40500:2012) and any of it subsequent revisions[194].

7.2 The [responsible authority] shall provide training and support to public sector organizations[195] to ensure implementation of the requirements for web accessibility.

7.3 [The responsible authority] should support the appointment or hiring of persons with disabilities as part of the implementation of this policy[196].

7.4 The [responsible authority] shall provide guidance regarding the availability of web accessibility development, and editing and testing tools in support of compliance with this policy within [three

---

[191] Convention on the Rights of Persons with Disabilities

[192] See, for example the International Association of Accessibility Professionals, www.accessibilityassociation.org

[193] Where this policy is implemented by the Ministry of ICT or an NRA, the annual review can be included in an annual forum on ICTs for persons with disabilities. See Module 1, section 4 for more information about the annual forum.

[194] See section 1.2 explaining why this model web accessibility policy favours international standards.

[195] Each policy should identify the relevant public sector organizations to be trained. For example, this would include all public sector organizations in the case of a national e-governance policy under the responsibility of the Ministry of ICT or all public hospitals, clinics and pharmacies in the case of a health sector policy.

[196] In general, hiring of persons with disabilities is encouraged at all level of implementation since it significantly increases the probability of adequate follow-up and success – not only technically but also as internal advocates.

months]. Such guidance shall be updated in accordance with web technology developments and available editing and testing tools in the marketplace[197].

7.5 Acknowledging the fact that the testing and elimination of accessibility errors of most web sites is a complex task requiring progressive implementation, the [responsible authority] shall promote and provide guidance for testing, prioritizing and resolving accessibility errors in a reasonable manner.

7.6 Where websites are outsourced by a government department or public agency, or awarded through grants provided by a department or agency, the government department or agency must ensure that the service providers are bound by these ICT Accessibility requirements[198].

8. Assessment of existing public sector websites and accessibility transition plans

8.1 In order to facilitate implementation of this policy, [Country] has done an assessment of existing e-government and public sector websites and found that the number of websites providing e-government services and information to the public at the time of publishing this web accessibility policy is [insert number of sites], and the number of public sector websites not available to the public is [insert number of sites]. A complete list of these websites and responsible agencies and the status of website accessibility of each is inserted in Annex A: List of public sector websites and responsible agencies or organizations covered by the web accessibility policy as of its publication, and shall be updated by the [responsible authority] annually[199].

8.2 Upon publication of this policy, each agency operating a website listed in Annex A shall appoint a web accessibility expert responsible to oversee the implementation of this policy in coordination with the [responsible agency].

8.3 Within [three months] of the publication of this policy, agencies and organizations operating websites listed in Annex A should update their procurement policies[200] to ensure that all purchases of products, software, technology or services related to the development, design, production, outsourcing or maintenance of their websites include accessibility criteria consistent with and facilitating their compliance with WCAG 2.0 (ISO/IEC 40500:2012) to the greatest possible extent. The [responsible agency] will offer guidance for such procurement policy update.

8.4 Within [three months] of publication of this policy, the [responsible authority] shall determine testing methodologies and metrics to assess the accessibility of public sector websites based upon WCAG 2.0 (ISO/IEC 40500:2012) levels of conformance. Such metrics should allow for consistent comparisons across areas of government and over time to measure progress.

8.5 Within [six months] of publication of this policy, departments, agencies and organizations operating websites listed in Annex A should complete a systematic assessment of their websites and website infrastructure and of their staff's skills and knowledge in readiness to apply WCAG 2.0 (ISO/IEC 40500:2012). A compliance report summarizing the results of this assessment must be submitted to the [responsible authority] including conformance test results following methodologies and metrics defined by the [responsible authority].

---

[197] There are a number of web editing and testing tools that can be identified and included as a link on the responsible authority's website to enable ease of compliance by government, and spread awareness. Examples of tools can be found on the web site of the Web Accessibility Initiative of the Worldwide Web Consortium at: www.w3.org/WAI/RC/tools/complete.

[198] See also Module 6: Accessible ICT public procurement policy framework.

[199] The requirement to assess the accessibility of websites should not delay adoption of this policy. The clause can be adapted, for example, to stipulate that such an assessment should be completed within [three months] of adoption of the policy. It is intended to at the very least provide clarity to which government departments and public institutions the policy applies. It can further be used to monitor progressive implementation of the policy. As such it should be adapted if necessary taking into account the particular country context.

[200] See Module 6: Accessible ICT public procurement policy framework.

8.6 Within [nine months] of publication of this policy, the [responsible authority] will consolidate the reports submitted as per paragraph 8.5 in order to provide a national web accessibility gap analysis with an assessment of the size and complexity of the tasks required to achieve compliance with WCAG 2.0 (ISO/IEC 40500:2012), and to develop transition plans, technical training, solutions and materials to assist agencies with their transition towards compliance with WCAG 2.0 (ISO/IEC 40500:2012).

8.7 Within [12 months] of the publication of this policy, departments, agencies and organizations operating websites listed in Annex A should finalize individual transition plans towards required conformance levels, including milestones with conformance metrics. Those plans will be consolidated by the [responsible authority] and shared with all organizations involved in implementing this policy.

9. Conformance levels for public websites

9.1 [responsible authority], based on the individual transition plans, shall approve the levels of conformance and timelines proposed by departments, agencies and organizations with the A or AA, conformance level for WCAG 2.0 (ISO/IEC 40500:2012).

9.2 Such conformance requirements and timelines will take into account the criticality of all the content and services provided to the public, the level of complexity to retrofit legacy web content and website architectures as well as the capacity of the individual agencies to implement their transition plans.

9.3 Notwithstanding the above dispositions in 9.1 and 9.2:

(a) All public sector web sites and webpages created later than [12 months] after the date of publication of this policy should meet ISO/IEC 40500:2012 Level A compliance;

(b) The timeline for level A compliance for all public sector web sites shall not exceed [two years] from the publication of this policy;

(c) The timeline for level AA compliance shall not exceed [four years] from the publication of this policy.

(d) Attainment of Level AAA is not mandatory; however, it is a conformance level that all website managers may consider. Level AAA conformance cannot be required for entire sites because it is often not possible to satisfy all Level AAA success criteria for some content.

9.4 Conformance should be according to the normative success criteria from WCAG 2.0, not on informative supporting documents such as techniques.

(a) The [responsible authority] will publish once a year [or other frequency as appropriate] a status report of the level of compliance with ISO/IEC 40500:2012 of all public websites, and recommend actions as necessary to achieve the goals of this policy.

10. Retroactive application and existing content of public websites

10.1 Public sector organizations must identify all current information on their existing websites and should archive obsolete information where appropriate. To improve the transparency of government information, agencies are encouraged to archive information online as citizens expect to retain access to electronic information.

10.2 When archived, a webpage should remain available to the public on a public sector website, but must be clearly identified as being archived. This disposition applies to the content of decommissioned websites unless such content are made available through a new or another public sector website.

10.3 Websites and web content created before the publication of this policy that are archived or decommissioned prior to [one year] after the publication of this policy are not required to meet WCAG 2.0 (ISO/IEC 40500:2012).

10.4 Public sector organizations remain liable for compliance of all web content that is not accessible, regardless of the fact that elements of it may be archived, and must take remedial action as needed. Archived content, however, may be made accessible as necessary and on a case by case basis.

11. Electronic documents available on public websites

11.1 Ensuring that electronic documents available on public sector websites are accessible is critical to ensuring that persons with disabilities can access on an equal basis with others. This includes all public information available in electronic documents or any fill-in form required to complete administrative processes.

11.2 All public departments and agencies managing websites listed in Annex A should ensure that all personnel creating documents are aware, trained and proficient in creating accessible documents and using accessibility checks embedded in mainstream office productivity software including word processors, spreadsheets, presentation and other commonly used document creation tools.

11.3 All new documents created with commonly used office productivity tools described in paragraph 11.2 above should be accessible at least [12 months] following the publication of this policy.

11.4 Each public department or agency must in its transition plan define a process to check the accessibility of current electronic documents used by the public in the normal course of their interaction with their websites and re-edit them in an accessible format as needed no later than [24 months] after the publication of this policy. Documents marked as archived documents are exempt from this disposition.

12. Dispositions for the private sector and civil society

12.1 [The responsible authority] should encourage the private sector and civil society to implement web accessibility and to adhere to the standards provided in this Model web accessibility policy by:

(a) Promoting in cooperation with industry associations and civil society entities, including disability organizations, the benefits for private sector and civil society organizations of adopting WCAG 2.0 (ISO/IEC 40500:2012).

(b) Coordinating and providing support for web accessibility awareness-raising and training programmes organized by professional societies, civil society, private training companies and academia.

(b) Facilitating the sharing of know-how, experience and methodologies of achieving conformance with WCAG 2.0 (ISO/IEC 40500:2012) among public and private sector and civil society entities.

(d) Encouraging public sector website personnel to join professional societies or other civil society organizations promoting web accessibility.

12.2 [The responsible authority] should seek to encourage industry professional associations to issue voluntary codes of conduct reflecting conformance objectives and timelines similar to those stipulated in this policy for public sector websites.

12.3 [The responsible authority] should support capacity building and training programmes for civil society organizations involved in promoting accessibility and the rights of persons with disabilities and involve those organizations to the greatest possible extent in all aspects of the implementation of this policy, including regular consultative activities and annual reviews of progress accomplished.

13. Responsibilities for the implementation of the policy

13.1 The [responsible authority] is responsible for:

(a) Leading by example and maintaining at least minimum technical requirements for web accessibility;

(b) Consolidating transition plans of all public sector websites identified in Annex A in order to guide the implementation of this policy across all agencies;

(c) Providing training and guidance on the interpretation of this policy;

(d) Evaluating and promoting across all government departments and agencies, technical solutions and web templates that are most effective and efficient at ensuring the accessibility of websites;

(e) Providing guidance on accessibility testing tools and testing procedures so that all parties use tools compatible with approved testing guidelines in order to produce uniform results and metrics;

(f) Establishing measurable targets in consultation with persons with disabilities, government web masters and other relevant stakeholders (in line with Module 1, sections 6 and 8), monitoring and publishing the progress made by public sector websites as measured by accessibility tests; and recommending actions as necessary to achieve the goals of this policy;

(g) Promoting the training and employment of persons with disabilities for web accessibility related projects and activities; and

(h) Organizing an [annual] review meeting on web accessibility for all stakeholders involved in the implementation of this policy in order to share progress accomplished, good practices and solutions.

13.2 Information systems department and webmasters of agencies listed in Annex A are responsible for:

(a) Ensuring compliance with this policy;

(b) Preparing accessibility transition plans;

(c) Choosing and implementing solutions to resolve issues of website design or inadequacies of content management systems;

(d) Ensuring availability of web authoring tools that support the production of accessible web content;

(e) Automating to the greatest possible extent real-time accessibility checking for editors;

(f) Training users and staff internally on web accessibility;

(g) Organizing the on-going testing of the accessibility of their websites; and

(h) Remedying identified accessibility issues for the web content they manage.

13.3 Departments and other entities contributing web content and electronic documents for inclusion on public websites are responsible for:

(a) Ensuring that their editing personnel are trained to produce accessible webpages and documents, where possible using software that supports the production of accessible content with approaches described in the Authoring Tool Accessibility Guidelines (ATAG) 2.0;

(b) Ensuring that the content they submit for posting is compliant with this policy;

(c) Remedying accessibility issues for the web content they author or produce; and

(d) Seeking internal or external assistance for authoring and/or testing content.

14. Targets and reporting requirements

14.1 In addition to the monitoring and evaluation conducted by [the responsible authority] in line with section 13.1 above, milestones should be set to measure capacity to implement the web accessibility policy (e.g. establishing necessary budgets and training programmes).

14.2 Access to information about ICT accessibility for the disability community is critical to ensuring that future reviews of accessibility policy measures are effective and that policy interventions are evidence-based. To achieve this, the NRA should determine reporting requirements for notifying the disability community about the accessibility requirements contained in the policy. A thorough review should be conducted by [the responsible authority] of *all* reporting requirements to ensure that the correct data is collected with respect to accessibility for persons with disabilities, at the right level of detail and at reasonable intervals.

15. Periodic review

15.3 Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

Annex A: List of public sector web sites and responsible agencies or organizations covered by the web accessibility policy as of its publication

[Insert list here]

Agency	Website	URL	Date of Creation	Contact Information	

Annex B: Resources for policy implementation and technical references[201]

Introduction to web accessibility

Summary: Introduction to web accessibility
Reference: www.w3.org/WAI/intro/accessibility
Keywords: Web accessibility
Target Audience: Web developers; accessibility policy-makers; everyone

---

Summary: How people with disabilities use the web
Reference: www.w3.org/WAI/intro/people-use-web
Keywords: disability; web access; assistive technology
Target Audience: Everyone

Summary: Overview of Web Accessibility for Policy-makers
Reference: www.e-accessibilitytoolkit.org/toolkit/technology_areas/websites
Keywords: web accessibility, policy making
Target Audience: Policy-makers

Summary: Business case for accessibility
Reference: www.w3.org/WAI/bcase/
Keywords: W3C; accessibility; business case
Target Audience: Web developers; IT executives; activists

Standards and Guidelines

Summary: Web Content Accessibility Guidelines (WCAG) 2.0 (standard)
Reference: www.w3.org/TR/WCAG/
Keywords: Web accessibility, WCAG
Target Audience: Web developers; accessibility policy-makers; everyone

---

Summary: How to Meet WCAG 2.0: A customizable quick reference for Web Developers
Reference: www.w3.org/WAI/WCAG20/quickref/
Keywords: Web accessibility, WCAG
Target Audience: Web developers; accessibility policy-makers; everyone

---

Summary: Web Content Accessibility Guidelines Overview
Reference: www.w3.org/WAI/intro/wcag
Keywords: W3C; WCAG; WAI; accessibility guidelines
Target Audience: Web developers; accessibility policy-makers

Summary: W3C-WAI resources for web accessibility implementation:
References:
Designing for Inclusion www.w3.org/WAI/users/
Implementation Plan for Web Accessibility www.w3.org/WAI/impl/
Involving Users in Web Projects for Better, Easier Accessibility www.w3.org/WAI/users/involving

---

[201] Adapted from the ITU-G3ict Policy Toolkit for Persons with Disabilities www.e-accessibilitytoolkit.org

Evaluating web accessibility www.w3.org/WAI/eval/
Before and After Demonstration (BAD) www.w3.org/WAI/demos/bad/
Keywords: Web accessibility, WCAG, web accessibility tools, web accessibility methods
Target Audience: Web developers; accessibility policy-makers; everyone

---

Summary: Web Accessibility in Mind – trainings, articles and material
Reference: www.webaim.org/
Keywords: Web accessibility; training; articles
Target Audience: Web developers

Summary: W3C resources on mobile accessibility, including applications of WCAG 2.0 to mobile content and applications, and application of the User Agent Accessibility Guidelines (UAAG) 2.0 to mobile application user interfaces.
Reference: www.w3.org/WAI/mobile/
Keywords: Mobile; accessibility; disability
Target Audience: Web developers

Summary: W3C web accessibility training material
Reference: www.w3.org/WAI/training/
Keywords: web accessibility training
Target Audience: Web accessibility trainers; web developers

Summary: International survey of web accessibility policies
Reference: http://g3ict.org/resource_center/publications_and_reports/p/productCategory_whitepapers/subCat_7/id_150
Keywords: Accessibility policy survey; regulation
Target Audience: Policy-makers

Developments and Trends

Summary: Mobile Web Best Practices (MWBP)
Reference: www.w3.org/TR/mobile-bp/ ; www.w3.org/TR/mwbp-wcag/#contents
Keywords: Mobile web; accessibility; best practices
Target Audience: Web developers

Summary: Accessible rich Internet applications guidelines overview
Reference: www.w3.org/WAI/intro/aria
Keywords: W3C; WAI; ARIA; rich media
Target Audience: Web developers

Annex C: Web Content Accessibility Guidelines 2.0

The Web Content Accessibility Guidelines (WCAG 2.0)[202] – (ISO/IEC 40500:2012) define how to make web content more accessible to persons with a wide range of disabilities as well as to older persons with changing abilities due to ageing. They often help improve usability for all users. Although these guidelines cover a large number of issues, they are not able to address the needs of persons with all types, degrees and combinations of disability.

WCAG 2.0 has 12 guidelines that are organized under four principles (perceivable, operable, understandable, and robust.) The table below indicates how the 12 guidelines may improve accessibility for users with various types of disabilities. For more precise information on how the specific provisions of WCAG 2.0 (the "Success Criteria") help people with different types of disabilities, look for "Specific Benefits of Success Criterion" followed by a Success Criterion number in "Understanding WCAG 2.0"[203].

Examples of Impairment or Disability addressed by the Four Principles and 12 Guidelines of WCAG 2.0	**Sight**	**Physical**	**Hearing**	**Cognitive**	**Speech**	**Neurological**	**Language**	**Learning**
Perceivable								
Provide text alternatives for non-text content.	X		X	X			X	X
Provide captions and audio descriptions for videos and other alternatives for multimedia.	X		X	X		X	X	X
Create content that can be presented in different ways, including by assistive technologies, without losing meaning.	X		X	X		X	X	X
Make it easier for users to see and hear content including separating foreground from background.	X		X			X		X
Operable								
Make all functionality available from a keyboard.	X	X			X	X	X	X
Provide users enough time to read and use content.	X	X	X	X	X	X	X	X
Do not design content in a way that causes seizures.				X		X		
Help users navigate and find content.	X	X	X	X		X		X
Understandable								
Make text content readable and understandable.	X			X	X		X	X
Make webpages appear and operate in predictable ways.	X	X		X			X	X
Help users avoid and correct mistakes.				X		X	X	X
Robust								
Maximize compatibility with current and future user tools, including assistive technologies.	X	X	X	X	X	X	X	X

202 www.w3.org/TR/WCAG/

203 www.w3.org/TR/UNDERSTANDING-WCAG20/

Module 6: Accessible ICT public procurement policy framework

This model policy is intended to guide all government bodies in the public procurement of accessible information and communication technology (ICT) equipment and services. Public procurement policies that require government agencies to procure accessible ICT equipment and services serve two key goals. Firstly, by procuring the most accessible ICT equipment and services, government bodies can provide an accessible work environment for its employees and accessible public services for its citizens. Secondly, the public procurement of accessible ICTs creates a market for accessible ICTs. Manufacturers and service providers are incentivized to produce accessible ICTs and suppliers to stock accessible ICTs. This generates greater competition, drives down costs and promotes a greater availability of accessible ICT products and services in the marketplace. Accessible ICT procurement is highly relevant given that fifteen per cent of the world's population lives with some form of disability and many nations have increasing elderly populations that live with age-related disabilities. Moreover, accessible ICT public procurement is in line with the United Nations Convention on the Rights of Persons with Disabilities.

Obligations of States Parties to the Convention on the Rights of Persons with Disabilities in matters of procurement

The UN Convention on the Rights of Persons with Disabilities (hereinafter the Convention) recognizes the accessibility of information communication technologies (ICTs) both as a human right (Article 9) and as an enabler of other human rights as prescribed in other articles of the Convention.

Articles 4(a) to 4(d) under "General obligations" further require that signatories adopt appropriate legislative, administrative and other measures to ensure these rights are met and to refrain from any act or practice that is inconsistent with the Convention. Public authorities and institutions are in particular required to act in conformity with the Convention. The procurement of ICTs for use by the public that are not usable and accessible by persons with disabilities may be deemed to be in contravention of the Convention.

In order to facilitate and monitor the implementation of the Convention, it is provided that State Parties should report on:

- legislative and other measures taken to ensure access by persons with disabilities, on an equal basis with others, to the physical environment, to transportation and to information and communications;
- technical standards and guidelines for accessibility put in place to achieve the goal above, as well as provisions on the auditing of their fulfilment and sanctions for noncompliance and what resources are applied to encourage accessibility actions;
- the use of public procurement provisions and other measures that establish compulsory accessibility requirements;
- the identification and elimination of obstacles and barriers to accessibility from within both the public and the private sector, and
- national accessibility plans established with clear targets and deadlines.

Some countries, furthermore, have legislation mandating that government agencies employ a certain quota of persons with disabilities. Having accessible ICTs is a necessary condition to make the workplace accessible and creates major benefits for government agencies and employees alike.

It is within this context that the accessible ICT public procurement policy framework module has been developed.

Elements of an accessible ICT public procurement policy

This module recognises that addressing the ICT accessibility needs of persons with disabilities can be achieved more cost effectively by considering them in the earliest stage of the procurement and development process. This is in line with Article 9(h) of the Convention which requires countries to

"promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost".

In order to fulfil their obligation to purchase accessible ICT products and services, public procurement agencies must implement the following steps:

- include clear statements of user accessibility needs in all calls for tender, based on internationally recognised standards;
- apply systematic and commonly used conformity assessment processes to confirm that the ICT products and services to be procured reach the stated level of accessibility conformance.

In practice, the first step may be achieved through citing in the Call for Tender a set of "functional performance statements" that reflect users' needs referenced from international accessibility standards. Two such standards, Section 508 of the U.S. Rehabilitation Act (Section 508) and European Standard EN 301 549[204]; "Accessibility requirements for public procurement of ICT products and services in Europe (EN 301549), contain an almost identical set of functional performance statements.[205]

Functional performance statements are designed to be used as a relatively easy to read description of the functional performance of ICTs required to enable users with disabilities to locate, identify, and operate ICT functions, and to access the information provided, regardless of physical, cognitive or sensory abilities. They may be used as either mandatory requirements or award criteria.[206]

While specific language and definitions differ between section 508 and EN 301 549, these two standards follow the same user-centric logic to determine whether a product or service can be operated by a person with disability to the same extent as by a person without a disability. It is important to note that both the United States Access Board and the European Commission have cooperated informally over time on aligning their approach to the development of standards for public procurement of accessible ICTs and that the revisions to Section 508, underway at the time of publication of this report, is expected to align with EN 301549 in 2015. Such cooperation reflects the general understanding among all stakeholders that the use of global standards helps achieve economies of scale, lowers costs and ensures interoperability. For these reasons, this model policy proposes that all public bodies procuring accessible ICTs should adopt a set of generally accepted functional performance statements, preferably by referencing one of these two standards[207].

This model policy provides for several methods to assess the accessibility of the proposed ICT solution depending upon the nature and complexity of the product or service purchased including off the shelf products, custom built products, integrated systems, system development, content development or

---

[204] References for these two standards are provided in Annex A: Standards. The U.S. Access Board Section 508 Standards for Electronic and Information Technology is currently under revision. The more recent EN 301 549 was produced by the ETSI Technical Committee Human Factors (HF), and the eAccessibility Joint Working Group (JWG) of CEN/CENELEC/ETSI. The European Committee for Standardization/ The European Committee for Electrotechnical Standardization/ The European Telecommunications Standards Institute. European Standards use the abbreviation "EN".

[205] Both standards also contain a large number of detailed technical accessibility requirements. Technical accessibility requirements are objective and measurable outcomes that an ICT product or service can meet or fail to meet. Both standards also provide a mapping that shows which of the requirements support each of the functional performance statements.

[206] Procurers may require suppliers to confirm in their responses that the proposed ICT solution conforms to these high level statements. One way to achieve this is to require suppliers to provide details that the proposed solution meets all relevant technical accessibility requirements.

[207] Should an international standard be developed for public procurement of accessible ICTs, e.g. an ISO international standard, public procurement agencies could apply such a standard.

services. In all cases, the adoption of a clear and systematic method of conformity assessment is an essential feature for an accessible ICT accessibility public procurement policy.

One commonly used method of conformity assessment is to request in the calls for tender that suppliers provide in their responses a detailed declaration on how their product conforms to the stated accessibility standard. This “self declaration of conformity” comprises of a template filled out by the supplier. A voluntary initiative led by the Information Technology Industry Council (ITI) in cooperation with the U.S. Access Board has developed "Voluntary Product Accessibility Templates – VPATs[208]", the purpose of which is to simplify the evaluation by public procurement agents of the level of compliance of individual products with U.S. Section 508[209].

This model policy recommends the use of templates as a cornerstone in the assessment of the conformity of ICT products and services with the relevant accessibility standard. For example VPATs provide a publicly available description of the conformance of many commonly available ICT products with Section 508. See Annex C for a sample template that may be used in the Call for Tenders. Countries at the initial stages of developing and implementing an accessible ICT public procurement policy and process may choose to recognize the evaluation of off-the-shelf ICT products conducted by countries with longer experience in this domain.

Annexes A and B refer to suitable standards when formulating accessibility requirements for the purposes of achieving conformance with functional performance statements, and Annex D contains a number of resources that may be used in the development of training programmes and capacity building exercises.

[208] See ITI web site at: www.itic.org/public-policy/accessibility. In the United States, the Information Technology Industry Council – ITI – houses the Voluntary Product Accessibility Template®, or VPAT®, a tool used to document a product's conformance with accessibility standards. The VPAT assists federal contracting officials and other buyers in making preliminary assessments regarding the availability of commercial "Electronic and Information Technology" products and services with features that support accessibility.

[209] Such VPATs may evolve over time to encompass additional standards such as EN 301 549 and the ISO standard on web accessibility. ISO/IEC 40500 (2012): "Information technology – W3C Web Content Accessibility Guidelines (WCAG) 2.0. See also Module 5: Web accessibility policy framework.

Model accessible ICT public procurement policy

1. Definitions[210]

- **"Accessibility"**[211] refers to the extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of characteristics[212] and capabilities, to achieve a specified goal in a specified context of use.[213]
- "**Accessibility requirements"** means a precise and testable description of each feature of the ICT solution to be procured.[214]
- **"Assistive technology"** means hardware or software added to, connected to, or incorporated within, a system that increases accessibility for an individual.[215]
- "**Functional performance statements:** a series of statements that describe routine human sensory, physical and cognitive capabilities. In the context of this policy, the Functional Performance Statements contained in the standards in Annex A, and quoted in Annex B, describe both the capabilities that enable persons with disabilities to interact with an ICT product or service, and the features the ICT needs to provide when a physical, cognitive or sensory capability is not available or cannot be used.

  NOTE 1: Functional Performance Statements are intended for use by the procuring authority to describe, at a high level, the needs of end users with disabilities in relation to the ICT solution to be procured.

  NOTE 2: Procuring authorities may more precisely describe the exact *accessibility requirements* of the ICT solution to be procured through referencing relevant and appropriate standards.
- **"Information and communication technologies (ICT)"** encompass a wide range of hardware and software, devices and computers, formats and systems that enable communication through electronic means. This includes devices and systems used for the storage, processing and retrieval of electronic information to the array of devices and software used to retrieve this information, as well as those used to communicate, in real-time, with other people.[216]

---

[210] Government procurement officials are not necessarily instructed by the national ICT policy and legislative framework. For this reason the definitions and references used in this module may vary from those in Module 1 to 4 which were designed for national ICT policy-makers and regulators. Nevertheless, countries developing public procurement policies may wish to incorporate some of the definitions used in the earlier modules of this report as relevant, such as those found in Module 1, Box 1.

[211] Accessibility is also defined within the context of usability in a number of standards including ISO/TR 9241-20: 2008 and ISO/IEC 26513:2009.Usability of a product, service, environment or facility by individuals with the widest range of capabilities."

[212] The range of characteristics and capabilities and individuals with the widest range of capabilities is generally considered to cover the capabilities of a wide range of users, including persons with a disability and persons experiencing some form of temporary difficulty.

[213] "Context of use includes direct use or use supported by assistive technologies." (from ISO 26800:2011 [i.16], ISO/TR 9241-100:2010, ISO/TR 22411:2008). Context of use is defined as "users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used" (from ISO 9241-110 [i.14].

[214] Accessibility requirements should be carefully chosen from relevant international standards developed specifically for use in the procurement of accessible ICTs. Annex A contains a list of standards recommended by this policy for use in the procurement of accessible ICTs.

[215] From ISO 9241-171 [i.15]

[216] Article 2 of the United Nations Convention on the Rights of Persons with Disabilities defines "communications" to include: "Languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-

- "**Persons with disabilities**" means individuals who have long-term [217] physical, mental, intellectual or sensory impairments, which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others. Older persons with functional disabilities are also regarded as persons with disabilities.[218]
- **"User"** means a person who interacts with the product, service or environment.[219]

2. Introduction to accessible ICT public procurement policy

2.1 This policy may be cited as the "Accessible ICT public procurement policy", and shall come into effect upon publication in the [official government publication]. This policy must also be published in a range of other fora in an accessible format to ensure widespread awareness of the requirements set out herein.

2.2 [Country] is committed to ensuring persons with disabilities have access on an equal basis with all other citizens to all government programmes, services and information. Essential to meeting this objective is that all Information and Communication Technologies (ICTs) provided by public authorities and/or used by public authority staff is accessible to and usable by persons with disabilities. This policy endeavours to put in place key elements of an accessible ICT public procurement system such that all stakeholders, including public sector staff, persons with disabilities and industry benefit from clearly defined public procurement procedures.

2.3 [Country] is a signatory to/ has ratified] the United Nations Convention on the Rights of Persons with Disabilities ("the CRPD" or "the Convention"), which came into force in May 2008. The Convention requires signatories to adopt appropriate measures to ensure access by persons with disabilities to information and communication technology, emergency services and Internet services on an equal basis with others.[220]

2.4 ICTs are specifically covered by the Convention, which states in Article 9 that: '"To enable persons with disabilities to live independently and participate fully in all aspects of life, State Parties shall take appropriate measures to ensure persons with disabilities have access, on an equal basis with others,

---

language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communication technology." See Section 3.4 for examples of mainstream ICTs commonly procured by public authorities.

[217] As defined in Article 1, UN Convention on the Rights of Persons with Disabilities

[218] In some countries, such as the United States, disability policy does not distinguish between people who have temporary or long term disabilities and each country will decide how it wishes to define persons with disabilities.

[219] Adapted from ISO 9241-11:1998. (from ISO/IEC Guide 71:2001, 3.6; CEN/CENELEC Guide 6:2002, 3.6)

[220] As per the CRPD, Article 9. The following obligation, among others, are included in the CRPD:

- The obligation for States Parties to ensure that persons with disabilities have access to information and communication technologies
- All content, communication, hardware, software and interfaces to be accessible
- Promotion of assistive technologies and information in alternative formats to persons with disabilities to ensure their access to information
- General information for the public must be made available in accessible formats and technologies for persons with disabilities at no extra cost
- Accessibility of mobile communication and services, including the internet is to be promoted especially in developing countries. Services are being accessed through computers, mobile phones and other emerging technologies and platforms

to the physical environment, to transportation, to information and communications, including information and communications technologies and systems..."

2.5 Article 32 (a) of the CRPD on "International Cooperation" requires that international development programmes are inclusive of and accessible to persons with disabilities. In support of this aim, this policy may be used for procurement utilizing both monies received from international aid programmes and monies from domestic revenues.

2.6 The [Relevant Ministry and Central Procurement Authority] are the bodies responsible for national, regional and local public procurement so as to provide public bodies with products and services that enable them to carry out their tasks to the benefit of citizens and businesses, including accessibility for persons with disabilities. The [Relevant Ministry and Central Procurement Authority] are the lead authorities in charge of promoting, implementing and enforcing, the Accessible ICT public procurement policy. A detailed listing of roles and responsibilities under the current policy are set out in section 3.[221]

2.7 This policy:

2.7.1 Identifies roles and responsibilities;

2.7.2 Defines and incorporates accessibility as an attribute in the procurement of ICTs, including as a criterion in the Call for Tender or Request for Proposals;

2.7.3 Promotes the identification and use of appropriate standards; and

2.7.4 Provides guidance on how to verify that accessibility requirements are specified in the procurement process – from the original Call for Tender to contract management.

2.8 This policy may also be adopted and used at regional or other administrative levels to enhance accessible public procurement policy and practices throughout the public sector.

2.9 At a national level, a number of policy and legislative instruments contain key provisions that support the stated goal of this policy, namely to ensure that accessibility is included as a criterion in the public procurement of ICTs. These include:

2.9.1 [National procurement policy/legislation, [citation], [brief description];

2.9.2 [Programmes for achieving public sector efficiencies and/or socially responsible behaviour];[222]

2.9.3 [E-government policy/legislation], [citation], [brief description];

2.9.4 [Access to public information policy/legislation], [citation], [brief description];

2.9.5 [Anti-discrimination/equality policy/ legislation], [citation], [brief description];

2.9.6 [Persons with disabilities policy/legislation], [citation], [brief description];

2.9.7 [Employment of staff by public authorities], [brief description, including any targets for employing persons with disabilities]; and

2.9.8 [Other policy/legislation], [citation], [brief description].

2.10 Many countries are currently undergoing a process of public sector reform. By including accessibility as a consideration at the earliest stages of the development and procurement of an ICT product or service, public authorities will realize significant cost savings through avoiding

[221] The responsible entities will depend on a particular country's procurement framework and this section should be adapted in line with this.

[222] Organizations around the world, and their stakeholders, are becoming increasingly aware of the need for and benefits of socially responsible behaviour. The objective of social responsibility is to contribute to sustainable development. Likewise, public procurers are becoming increasingly aware of the potential benefits of socially responsible public procurement, i.e. procurement operations that take into account one or more social considerations, of which accessibility can be one. Public authorities that wish to achieve social objectives and have established a strategy for implementing socially responsible public procurement should consider incorporating accessible procurement in that strategy.

costly retrofitting of ICT products and services post-procurement, enabling citizens to access government programmes, services and information and helping to enable public sector staff with disabilities to productively work in an inclusive work environment.

2.11 Other actions and conditions that may contribute to the effective adoption and use of the Accessible ICT public procurement policy include:

2.11.1 A strong political commitment at the highest level to implement the current policy;

2.11.2 Where a national policy for implementation of the CRPD exists, the Accessible ICT public procurement policy should be referenced and supported by that policy; and

2.11.3 Public procurement systems can legitimately and objectively recognize accessible procurement alongside those of transparency, non-discrimination and fair competition.

2.12 It is not sufficient that public authorities integrate accessibility solely in the procurement process. Public authorities need to incorporate accessibility requirements equally into all their ICT related policies and procedures, including the use of “freeware”, “free services”, and on-going maintenance of ICT systems.

3. Objectives

3.1 Recognizing that public procurement can be used to assist in realizing social goals, this policy aims to contribute to:

3.1.1 Improving the lives of persons with disabilities through ensuring public bodies utilize accessible ICTs in the delivery of public services;

3.1.2 Providing ICT systems and services to the public that are usable and accessible by the widest range of people possible;

3.1.3 Creating an accessible employment environment within the public sector;

3.1.4 Increasing market demand for accessibility features in ICT products and services by leveraging on the purchasing power of the government;

3.1.5 Encouraging industry competition to design, develop and provide more accessible mainstream ICT solutions and, thus, increase the market supply for accessible solutions; and

3.1.6 Affecting the market to yield more accessible ICT at lower cost by shifting both the market supply and demand as mentioned above.

3.2 Recognizing the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms, the following principles must be adhered to and underpin this policy:

3.2.1 Non-discrimination;

3.2.2 Inclusion;

3.2.3 Accessibility;

3.2.4 Transparency;

3.2.5 Affordability; and

3.2.6 Value for money.

3.3 The objective of this policy is to provide an enabling framework to support the public procurement of accessible ICTs through:

3.3.1 Defining the general principles by which public procurement practices may incorporate accessibility;

3.3.2 Defining a high-level set of user needs, called "Functional Performance Statements" that clearly define the needs of end users who benefit from accessible ICT;

3.3.3 Identifying the critical stages and activities of the procurement process during which accessibility should be considered. These include;

a. The preparatory study including needs analysis;

b. Writing the "Call for Tender" or "Request for Proposals";

c. The "Mandatory Requirements" within the "Call for Tender"

d. Criteria within the Call for Tender such as those used to select a tenderer capable of performing the proposed contract; and those used to assess the most economically advantageous tender.

e. Verification of compliance;

f. Accessibility in contract clauses; and

g. Accessibility in contract management.

3.3.4 Defining the scope of ICTs for which accessibility shall be considered for public procurement.[223]

3.4 This policy is applicable to the procurement and use of all ICTs within the public sector, including, but not limited to:

3.4.1 Desktop personal computers, laptops, computer and laptop peripherals such as screens, keyboards, mice;

3.4.2 Mobile devices and applications such as smart phones, tablets and related mobile applications;

3.4.3 Hardware such as servers, printers, switchboards, private automatic branch exchanges (PABX);

3.4.4 Self-service terminals, ticket machines and other stand-alone hardware used to provide public access to a service;

3.4.5 Software such as office productivity applications including word processors, spreadsheets and databases;

3.4.6 Telecommunication services such as landline, mobile, and Voice over IP;

3.4.7 Audio visual and video services

3.4.8 Web and intranet development services;

3.4.9 Cloud computing services;

3.4.10 Software development and maintenance services;

3.4.11 Emergency telephone, broadcasting and ICT-based public awareness services; and

3.4.12 Social media services.

3.5 Public authorities should ensure that persons with disabilities have access to public services via ICT by, in the first instance, adopting and implementing this Accessible ICT public procurement policy for the public procurement of all ICTs.

[223]This policy supports the inclusion of accessibility in all stages of the procurement process. However not all of the stages may be relevant for all procurement exercises. For example, a Call for Tender may not specify "Mandatory Requirements", or there may be no contract management for each procurement, procuring authorities may decide which of the stages above should include accessibility as a criterion or factor, thereby providing different 'paths' to an accessible procurement exercise.

4. Roles and responsibilities

4.1 At the national level the [relevant ministry and regulatory authority] shall identify the most relevant public sector personnel and assign clear responsibilities for ensuring the adoption, awareness training and use of this policy. This may include public sector roles and responsibilities such as:

4.1.1 [relevant ministry and regulatory authority], including the senior official with overall responsibility for public procurement;

4.1.2 [Government Chief Information Officer];

4.1.3 [The most relevant cross-departmental committees/councils with responsibilities for procurement strategy, ICT strategy and deployment];

4.1.4 [Senior official in each government department/agency with responsibility for public procurement];

4.1.5 [Head of IT/Chief Information Officer in each government department/agency].

4.2 Key roles to be assigned to relevant senior officials and/or councils/committees include:

4.2.1 Training, capacity building and awareness raising of this policy, ICT accessibility, procurement and management of accessible ICTs for use by the public and public sector staff;

4.2.2 Definition of harmonized standards, Functional Performance Statements and accessibility requirements to be used in all stages of the public procurement process;

4.2.3 Development of training and awareness programmes for staff to ensure a consistent level of awareness and capacity in implementing the policy across all public authorities; and

4.2.4 Development of a library of practical resources and best practice examples for use by staff in conducting accessible ICT procurement exercises. These resources may include examples of templates, such as the one provided in Annex C and sample text for use in Call for Tenders based on the approach outlined in section 8 below.

4.3 The [relevant ministry and regulatory authority] shall set up or assign responsibility to an appropriate existing cross-departmental monitoring committee responsible for monitoring, surveying and reporting to the [relevant ministry and regulatory authority] compliance by all public authorities with the "Accessible ICT public procurement policy". This committee or council shall:

4.3.1 Set a date by which all public authorities shall adopt this policy;

4.3.2 Require all public authorities to periodically report on their progress towards implementing this policy; and

4.3.3 Carry out other monitoring activities as required under section 16 on "Monitoring and Evaluation" of the current policy.

4.4 Most enterprise-level ICT requires design, implementation, and maintenance by the public authority to deliver and uphold an accessible experience for the end users.[224]

[224] For example, in cases where staff is permitted to contribute content to a website though a Content Management System (CMS), the accessibility of the website is dependent on both the capacity of the CMS to publish accessible content, and on the capacity of staff to ensure their content is accessible.

5. Training, capacity building and awareness raising

5.1 The [relevant ministry and regulatory authority] shall take steps to ensure that all public authorities are aware of the intent and provisions of this policy for Accessible ICT Public Procurement and that relevant staff are trained in its use.

5.2 The [relevant ministry and regulatory authority] shall ensure that public authorities receive appropriate training and capacity building in including accessibility as a criterion in the procurement of ICTs. Learning outcomes from this training may include:

5.2.1 What is meant by accessibility;

5.2.2 How persons with disabilities use ICT;

5.2.3 The case for accessible ICT: social and business;

5.2.4 How to specify and evaluate accessibility in a procurement process;

5.2.5 How to request and evaluate evidence that a proposed solution is accessible; and

5.2.6 Relevant standards, guidelines, legislation and policy related to the public procurement of accessible ICTs

5.3 The [relevant ministry and regulatory authority] may develop training materials and practical toolkits to assist both their own staff and relevant staff in public authorities in learning about accessible ICT procurement and achieving the learning objectives defined in section 5.2 above.[225]

5.4 The [relevant ministry and regulatory authority] and all public authorities shall make efforts to ensure that persons with disabilities and their representative bodies are made aware of the availability of new and existing means of access to public services delivered via accessible ICT. This should include gathering feedback on the experiences to date of persons with disabilities in using those public services delivered via accessible ICT.

5.5 The [relevant ministry and regulatory authority] should provide a contact point within the authority that actively seeks and receives feedback from industry on the clarity and effectiveness with which accessibility criteria are specified in public requests for tenders.

5.6 All best practices examples, practical resources, toolkits, training materials and other relevant materials shall be made available to all public sector staff via a central website or intranet, or by other means, as appropriate. This content shall be maintained and updated by an appropriate public authority such as the [relevant ministry and regulatory authority], [Central Procurement Authority] or the [Central Authority with responsibility for public sector staff development and training].[226]

6. Defining accessibility as an attribute in the procurement of ICT

6.1 Recognizing the need for procuring authorities to precisely define accessibility as an attribute in the procurement of ICTs, it is recommended that applicable functional performance statements, such as those specified in EN301549 clause 5 to 13, are quoted or clearly referenced in any Call for Tenders to describe the needs of persons with disabilities in accessing the full functionality and documentation of the ICT product or service.

[225] Annex D contains a number of resources that may be used in the development of such training programmes and capacity building exercises.

[226] Only one entity should be given responsibility in the final policy. This should be determined by the particular country context.

6.2 Procuring authorities may quote or provide a reference to commonly accepted and used standards as described in Annex A.[227]

7. Accessibility in the preparatory study

7.1 Where a procuring authority conducts a preparatory study prior to initiating a public procurement exercise, it shall include accessibility as a consideration in the study. This preparatory study shall lay the basis for a successful procurement exercise. The procuring authority may do this by considering:

7.1.1 The business needs the procurement is intended to fulfil;

7.1.2 The needs of all potential end users, in particular end users with disabilities; and

7.1.3 The market and its potential capacity to provide ICT services or solutions that meet the business and end users' needs identified above.

7.1.4 The procuring authority may in some cases engage in certain degree of system design as part of the project specification during preparatory stage. Note that decisions made at this stage may have significant impact on the eventual level of accessibility for the system. Achieving high level of accessibility starts in the planning stage prior to procurement.

7.2 Business needs:

7.2.1 Accessibility shall, where necessary, be considered in the analysis of business needs conducted as part of the preparatory study. System features that make products more usable for persons with disabilities can also make them more convenient and easier to use by others. Accessible features are particularly helpful when people have temporary difficulties or when environmental conditions are unfavourable, such as dim lighting, loud background noise, or busy activity among people nearby.

7.2.2 Where the needs of persons with disabilities are taken into account from the outset, the necessity for subsequent costly adaptations and individual solutions is reduced.

7.2.3 Other reasons for considering accessibility in the analysis of business needs are:

a. Accessible and usable products increase productivity;

b. Accessible and usable tools enable users to achieve their goals efficiently;

c. Accessible and usable products and services reduce usage costs since they reduce training time and errors;

d. Good accessibility and usability reduce the need for training and reduce the time in supporting users to solve problems and carry out tasks; and

e. Good accessibility and usability lead to increased work satisfaction, less stress and reduced absence due to illness.

7.3 User needs:

7.3.1 User needs should, where practical, be identified in order to establish a basis for the user requirements to be stated in the Mandatory Requirements and/or in Award Criteria. [228]

[227] The European Commission and the United States have established accessibility standards for use in the public procurement of ICT products and services. These are referred to as EN 301 549, "Accessibility requirements for public procurement of ICT products and services in Europe" and Section 508, U.S. Rehabilitation Act of 1973, respectively. Annex B contains the relevant text from EN 301 549 and Section 508.

[228] Where a sub-set of the accessibility requirements from the standards in Annex B are to be included as Mandatory Requirements, the procuring authority should confirm the market's capacity to deliver solutions that meet these Mandatory Requirements during the preparatory study.

Standards such as EN 301549 or Section 508 have been developed to identify for the procurer a diverse set of user needs.

7.3.2 Where ICT is to be purchased for a specific individual that ICT may only need to provide support for the particular needs of that individual.

7.4 Market capacity

7.4.1 The market's potential capacity to deliver accessible solutions should be investigated by the procuring authority. This can be achieved by including accessibility as a consideration in investigations, enquiries and interviews with potential suppliers.

7.4.2 Examples of strategies to assess the preparedness of the market to develop and supply accessible solutions include:

a. Asking potential suppliers about their current and future product development and establishing if accessibility will increasingly be built into the mainstream product and services offered, or if it will be an add-on feature.

b. Establishing which actors in the development and supply chain of the end solution (e.g. manufacturers, retailers) should be proficient in accessibility.[229]

c. Looking at various business models since accessibility requirements may depend on whether products and services are sold separately, bundled into packages, or whether products are sold as services.

d. In enquiries and interviews, including questions about whether and how accessibility is incorporated in the supplier's organization, policies, quality management system etc.

8. Requesting information in the Call for Tender on a supplier's accessibility capability

8.1 Where relevant, suppliers may be required to demonstrate their capability to deliver accessible ICT products or services. For example, a supplier's technical and/or professional capability in ICT accessibility is relevant where the subject matter of the procurement is a service such as web design, software development, outsourcing of operations of ICT infrastructure, call centre services etc.[230]

8.2 The [relevant ministry and regulatory authority] may define a specification of what constitutes a supplier with good ICT accessibility capabilities, taking into account that there are different kinds of suppliers in the ICT domain, e.g. manufacturers of hardware and software, service providers, system integrators, retailers and consultants. Procuring bodies shall require suppliers to provide evidence of their ICT accessibility capability. Examples of evidence that may be requested in the Call for Tender include:

8.2.1 A brief description of the suppliers' track record in the ICT accessibility domain;

8.2.2 A description of organization, staff, policy etc. concerning accessibility issues, signed by an authorized representative of the supplier; and

8.2.3 A third party attestation that the supplier complies with the specification referred to in section 8.1.

---

[229] For example, in the procurement of a Content Management System for use in managing websites, it may be desirable to gain an initial assessment of the accessibility capability of both the CMS manufacturers and the developer who will customize and install the CMS.

[230] Assessing the technical and/or professional capability of the supplier is less meaningful for procurement of standard off-the-shelf products.

9. Use of standards for formulating accessibility requirements

9.1 Procuring authorities shall use appropriate and internationally recognized ICT accessibility standards that are appropriate for use in the procurement of accessible ICT[231].

9.2 In the specification of Mandatory Requirements and Award Criteria, procuring authorities shall, to the greatest extent, refer to a relevant standard listed in Annex A.

9.3 The [relevant ministry and regulatory authority] shall monitor standardization developments and update this list according as relevant standards are finalized or updated.[232]

10. Including accessibility as a criterion in the Call for Tender for 'off the shelf' products[233]

10.1 Where relevant, procuring bodies may, in the Call for Tender, include an appropriate sub-set of the accessibility criteria contained in the standards set out in Annex A in the specification of Mandatory Requirements for the procurement, thereby ensuring that the delivered ICT meets the most important accessibility aspects[234].

10.2 In particular, accessibility requirements shall be included in the "Mandatory Requirements" description of the Call for Tender where the subject matter of the procurement is intended for use by either members of the public or by public sector employees, except possibly in duly justified cases. (See section 15 on "Exemptions").

---

[231] The systematic adoption and use of commonly accepted and used technical standards for procurement of accessible ICT is critical to the success of the procurement of accessible ICTs for several reasons:

- Significant economies of scale can be realized by both industry and government through the development and procurement of ICTs that follow common standards;
- Fragmentation between standards can occur when the use of locally developed standards is prioritized over adopting or contributing to the development of international standards; and
- There is a growing global trend towards the internationalization of accessible ICT standards which are currently in use or being adopted for use in regions such as Europe or North America, and in countries such as Australia, Korea, or Brazil.

In support of this, the Convention contains specific dispositions on the development, promulgation and use of commonly accepted standards and sharing of technical knowledge. Article 9 2(a) of the Convention promotes the development, promulgation, monitoring and implementation of "minimum standards and guidelines for the accessibility of facilities and services open or provided to the public." Likewise, Article 32 (b) and (c) respectively promote the exchange of information and cooperation in research and access to technical knowledge among State Parties.

[232] Efforts have been made to harmonize the Functional Performance Statement and criteria and the accessibility requirements in both the standards cited in Annex A (Draft EN 301 549 and Section 508). However to avoid confusion and to make the Call for Tender as clear as possible for potential suppliers, procuring authorities are encouraged to select one of these standards and to use and reference that standard consistently in the Call for Tender.

[233] 'Off the shelf' products are not subject to significant customization or development prior to delivery. Examples may include laptops, PCs, telephones, printers and cameras.

[234] A Product Accessibility Template can be attached to the Call for Tender for completion by a supplier. To the greatest extent possible the format of any such template should be based on a similar template used in other regions for use with the standards cited in Annex A.

The Call for Tender should include, at a minimum:

- A clear reference to the procurement competition for which it is to be used;
- A clear reference to the subject matter of the procurement;
- A clear reference to the standard from which the accessibility requirements are taken; and
- The entire list of relevant accessibility requirements which are relevant for this procurement taken from the standards included in Annex B which are relevant for this procurement.

A good guide on drafting a Call for Tender that includes accessibility, called W*riting a Request for Tender (RFT)* from the Centre of Excellence in Universal Design, can be found at:
http://universaldesign.ie/useandapply/ict/itprocurementtoolkit/stagesofprocurement/rft

10.3 Where the tender is intended customized or bespoke ICT solution, fulfilment and verification of the mandatory requirements upon delivery of the solution must be specified in the agreement.

10.4 Where on-going maintenance of ICT system is part of the tender, responsibility of maintaining, monitoring, and remediation of the ICT system accessibility performance must be specified in the agreement.

10.5 The procuring authority shall ensure that the accessibility requirements included as Mandatory Requirements are proportional and practical.

10.6 Where accessibility requirements are included they shall to the greatest extent possible be functional, i.e. specify functions and outcomes rather than technical solutions and be based on the accessibility requirements recommended by section 9 on use of standards.

10.7 Where tenders are to be evaluated on the basis of the Most Economically Advantageous Tender (MEAT), procuring authorities should include accessibility criteria in the specification of criteria for awarding of the contract, commonly called Award Criteria, thereby encouraging suppliers to adopt accessibility as a competition factor. Examples of criteria to be considered are:

10.7.1 The extent to which the relevant criteria based on the standards in Annex A are met;

10.7.2 Increased level of accessibility by referencing selected functional criteria beyond the set of requirements specified in the "Mandatory Requirements";

11. Including accessibility requirements in procurement for the development of products and services

11.1 For contracts on the development of a product or a service which is intended for use by persons, whether general public or staff of the procuring body, accessibility requirements shall be included in the specification of functions and performance of the product or service to be developed. This specification is part of both the "Call for Tender" and the Contract.

11.2 In procurement involving customized or bespoke products and services, particular attention shall be given to the inclusion of careful testing and compliance verification in the development process.

12. Verification of compliance with accessibility criteria in the Call for Tender

12.1 The procuring authority shall ensure that all claims of compliance by suppliers with the accessibility criteria specified in the Call for Tender are verified. Non-compliance may have severe consequences for users with disabilities.[235]

12.2 Depending on the type of product or service to be procured, and where accessibility comes about in the value chain of the technology components of a project, verification may take place pre-award or post-award:

12.2.1 Where the subject matter of the procurement is an 'off the shelf' product as described in section 10, verification of compliance shall be carried out during the evaluation of tenders in the pre-award phase of the procurement process.

12.2.2 Where the subject matter of the procurement is a customized or bespoke product or service as described in section 11, verification of compliance shall be carried out post-award, once the developed product is delivered and/or as part of the on-going delivery of the service.

[235] Inaccessible public service may hinder persons with disabilities from exerting their civic rights and obligations. Inaccessible ICT in the workplace may hinder disabled employees from performing their work in an effective manner. It must however be taken into account that accessibility can come about in different stages of the value chain.

12.3 Where the suppliers have access to attestations of compliance to an accessibility standard or the possibility to obtain them within the relevant time limit, the procuring body may request an attestation as proof of compliance.

12.4 Examples of relevant attestations that may be requested are:

12.4.1 A supplier's self-declaration of conformity;

12.4.2 A supplier's self-declaration of conformity, with supporting information on how the conformity assessment was carried out; [236]

12.4.3 A supplier's self-declaration of conformity, with supporting information on acceptance of results produced by bodies in other countries undertaking similar conformity assessments for off-the-shelf products and/or

12.4.4 A certificate, issued by an independent third party, as compliance verification (Third Party Certification).[237]

12.5 Procuring bodies may decide on a case-by-case basis which type of attestation to request. This decision must be based on a number of factors, including the degree of impartiality of the attestation required, impact on the user in the case of non-compliance, cost and time required to complete the conformity assessment by the supplier and appropriateness with respect to the development and manufacturing process of the subject matter of the procurement.

12.6 In most cases, a self-declaration of conformity may be sufficient, proportional and practical. A third party certification may be requested in cases where non-compliance could result in, for example, significant breaches of a user's privacy or in a risk to a user's health and safety.

12.7 Where the procuring body chooses to carry out the compliance verification in-house, and where the requirements are based on standards, the test methods (if any) specified in the standard shall be used. Other forms of testing that may be used include user testing, automated testing using specialised testing tools and validators and tools that simulate various sensory difficulties.[238] A suitably briefed and qualified team shall carry out the evaluation process.

12.8 In cases where a procuring authority in one country carries out a conformity assessment exercise on a particular ICT product or service and publishes the results, a procuring authority in another country may choose to recognise this assessment as evidence of conformity as part of their own procurement process.

---

[236] A self-declaration of conformity is a statement issued by a supplier or manufacturer, based on a decision following review, that fulfilment of specific requirements has been demonstrated. The decision and the review are made by the supplier or manufacturer. The supplier may refer to assessments, if any, made by other first, second or third parties, but the supplier is entirely responsible for the attestation.

[237] For more on the different conformity assessment types see CEN/CLC/ETSI TR 101 552 "Guidance for the application of conformity assessment to accessibility requirements for public procurement of ICT products and services in Europe". www.etsi.org/deliver/etsi_tr/101500_101599/101552/01.00.00_60/tr_101552v010000p.pdf

EN ISO/IEC 17000:2004 defines third party conformity assessment activity "as performed by a person or body that is independent of the person or organization that provides the object and of user interests in that object". The key word in this definition is "independent". Third party assessment is sometimes used by a manufacturer or supplier to support a first party declaration. Applicable standards include EN 45011 (see Annex A.7) for certification and EN ISO/IEC 17020 (see Annex A.5) for inspection.

[238] More on user testing may be found here: www.universaldesign.ie/useandapply/ict/universaldesignforict/usertesting. An extensive list of web accessibility validation tools is maintained by the W3C: www.w3.org/WAI/RC/tools/complete. One popular web accessibility validation and texting tool that incorporates simulation tests is the Web accessibility toolbar: www.paciellogroup.com/resources/wat/ie.

13. Accessibility in contract clauses

13.1 The procuring body shall ensure that the Contract sufficiently enables the procuring body to verify that the delivered product or service fulfils specified accessibility requirements during the course of the Contract. This means that the accessibility requirements and the verification process should be specified in the contract. The specification should include:

- Accessibility requirements and criteria specified in the Call for Tender, met by the offered product/service according to the tender,
- Where applicable, requirements agreed in negotiation,
- Statutory requirements.

14. Accessibility in contract management

14.1 Where the procuring body has established a set of procedures for the follow-up of a supplier's performance during the lifetime of the contract (also known as contract management)[239], these procedures shall include procedures for maintenance that agreed accessibility requirements continue to be met.

14.2 The procedure for follow-up of accessibility shall pay particular attention to the fact that accessibility issues during the lifetime of the contracted system are often related to how the ICT system is used, maintenance procedures and the continuous development of interoperability between added or modified system components, accessibility features of the system and assistive devices delivered by third party suppliers. User tests should therefore be included in the maintenance process.

15. Exemptions

15.1 Recognizing that the use or design of certain types of ICTs used for military, national security or intelligence purposes may need to be classified, the [Ministry for Finance and the national public procurement agency or other authority with responsibility for implementing and monitoring this policy] may define a set of conditions whereby such types of ICT are exempt from the application of this policy.

15.2 All other exemptions to the inclusion of accessibility as a requirement in the public procurement of an ICT product or service not covered by section 15.1 may be made through an application in writing to the [Ministry for Finance and the national public procurement agency or other authority with responsibility for implementing and monitoring this policy] outlining:

15.2.1 A description of the ICT to be procured;

15.2.2 The rationale for the exclusion of accessibility as a criterion in the procurement of these ICTs;

15.2.3 Accommodations to be in place so that members of the public with a disability shall be able to access on an equitable basis, the equivalent public information or services; and

15.2.4 Accommodations to be in place so that public sector staff with a disability shall be able to access on an equitable basis, the equivalent work-related information or services.

---

239 Other considerations for contract management include:

- monitoring of the delivery plan and accomplishment of the acceptance test,
- managing the supplier's performance against pre-determined quality criteria set out in the contract,
- managing changes and variations of the customers' needs, and
- the application of the contracted procedures to tackle changes.

16. Monitoring and evaluation

16.1 The [Ministry for Finance and the national public procurement agency or other authority with responsibility for implementing and monitoring this policy] shall ensure that all the measures outlined in the current policy are adopted by all public authorities procuring ICTs for use by the public or by employees of the public sector.

16.2 Monitoring may include checking the content of calls for tender published by public authorities for the inclusion of accessibility as a meaningful and measurable criterion in the procurement of ICT products and services and that the deployment of the ICT system achieve the level of accessibility as planned.

16.3 This policy shall be reviewed within at least two years. During the review process views will be sought from persons with disabilities, the Committee on ICT Accessibility[240], organizations representing persons with disabilities, public authorities implementing the policy and industry.

17 Periodic review

17.1 Due to the fast-moving technological developments and market conditions, this policy shall be reviewed at least every two years.

[240] See Module 1. Where a country does not establish such a committee, the same objective can be achieved through the regular review of existing regulations subject to public consultation that includes persons with disabilities.

Annex A: Standards

The following standards are deemed as suitable for use in formulating accessibility requirements for the purposes of achieving conformance with the functional performance statements:

- U.S. Access Board: "Information and Communication Technology (ICT) Standards and Guidelines" for Section 508 of the Rehabilitation Act and Section 255 of the Telecommunications Act of 1996[241]
- European Standard EN[242] 301 549; "Accessibility requirements for public procurement of ICT products and services in Europe"[243]

In addition, ISO/IEC 40500 (2012): "Information technology -- W3C Web Content Accessibility Guidelines (WCAG) 2.0"[244] may be referenced for procuring web technology, web development or web contents and services.

They may be used in:

- Defining accessibility requirements for the mandatory requirements in the Call for Tender
- Defining sub-criteria for the award criteria in the Call for Tender
- Defining accessibility requirements for use in the specification of functions and performance of the product or service to be developed to be included in the contract and the Call for Tender

[241] Compliance with these standards, Available at www.access-board.gov/attachments/article/490/draft-rule.pdf, is mandatory for federal agencies in the US pursuant to Section 508 of the Rehabilitation Act of 1973. This standard is currently in the process of being updated.

[242] European Standards use the abbreviation "EN".

[243] EN 301 549 available at www.etsi.org/deliver/etsi_en/301500_301599/301549/01.01.01_60/en_301549v010101p.pdf This new European Standard released in January 2014 is complemented by a series of three Technical Reports (TR 101 550, TR 101 551 and TR 101 552). Together, these documents set out accessibility requirements that can be applied to a wide range of products and services related to ICT, including computers, smartphones and other digital devices, ticketing machines, websites and emails. The aim is to ensure that ICT products and services are accessible either directly or through compatibility with assistive technologies such as text-to-speech, so that everyone can access information and use services that are delivered electronically.

[244] Available at: www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=58625. These are also referenced as: W3C: Web Content Accessibility Guidelines (WCAG) 2.0, W3C Recommendation, 11 December 2008 and are available at www.w3.org/TR/WCAG/. See Module 5 for more guidance on promoting web accessibility.

Annex B: Functional performance statements

The following two standards, EN 301 549, "Accessibility requirements for public procurement of ICT products and services in Europe" and Section 508, U.S. Rehabilitation Act of 1973, provide a framework which may be used to define ICT accessibility for procurement purposes. Although similar in scope and content, it is recommended not to alter the text of these statements or to mix and match them. The purpose and definition of functional performance statements are explained in the Model accessible ICT procurement policy in this module.

Box B1: Functional performance statements from EN 301 549 "Accessibility requirements for public procurement of ICT products and services in Europe"

1. Meeting functional performance statements

- The statements set out in this box are intended to describe the functional performance of ICT enabling people to locate, identify, and operate ICT functions, and to access the information provided, regardless of physical, cognitive or sensory abilities. Any ability impairments may be permanent, temporary or situational.
- ICT meeting the applicable requirements of clauses 5 to13 is deemed to have met a level of accessibility conformant with the present document and consistent with the user accessibility needs identified in clause 4.2 (Functional performance statements).
- *NOTE 1: The relationship between the requirements from clauses 5 to 13 and the accessibility-related user needs is set out in Annex B.EN 301 549 V1.1.1 (2014-02)*
- *NOTE 2: The intent of clause 4.2 is to describe the users' accessibility needs in accessing the full functionality and documentation of the product or the service with or without the use of assistive technologies.*
- *NOTE 3: The methods of meeting the accessibility needs of users with multiple impairments will depend on the specific combination of impairments. Meeting these user accessibility needs may be addressed by considering multiple clauses in 4.2.*
- *NOTE 4: Several users' accessibility needs rely on ICT providing specific modes of operation. If a user is to activate, engage or switch to the mode that complies with his or her user accessibility needs, the method for activating, engaging or switching to that mode is also expected to comply with the same user accessibility needs.*

2. Functional performance statements

2.1 Usage without vision

- Where ICT provides visual modes of operation, some users need ICT to provide at least one mode of operation that does not require vision.
- *NOTE: Audio and tactile user interfaces may contribute towards meeting this clause.*

2.2 Usage with limited vision

- Where ICT provides visual modes of operation, some users will need the ICT to provide features that enable users to make better use of their limited vision.
- *NOTE 1: Magnification, reduction of required field of vision and control of contrast, brightness and intensity can contribute towards meeting this clause.*
- *NOTE 2: Where significant features of the user interface are dependent on depth perception, the provision of additional methods of distinguishing between the features may contribute towards meeting this clause.*
- *NOTE 3: Users with limited vision may also benefit from non-visual access (see clause 2.1).*

2.3 Usage without perception of colour

- Where ICT provides visual modes of operation, some users will need the ICT to provide a visual mode of operation that does not require user perception of colour.
- *NOTE: Where significant features of the user interface are colour-coded, the provision of additional methods of distinguishing between the features may contribute towards meeting this clause.*

2.4 Usage without hearing

- Where ICT provides auditory modes of operation, some users need ICT to provide at least one mode of operation that does not require hearing.
- *NOTE: Visual and tactile user interfaces may contribute towards meeting this clause.*

2.5 Usage with limited hearing

- Where ICT provides auditory modes of operation, some users will need the ICT to provide enhanced audio features.
- NOTE 1: Enhancement of the audio clarity, reduction of background noise, increased range of volume and greater volume in the higher frequency range can contribute towards meeting this clause.
- NOTE 2: Users with limited hearing may also benefit from non-hearing access (see clause 2.4).EN 301 549 V1.1.1 (2014-02)

2.6 Usage without vocal capability

- Where ICT requires vocal input from users, some users will need the ICT to provide at least one mode of operation that does not require them to generate vocal output.
- *NOTE 1: This clause covers the alternatives to the use of orally-generated sounds, including speech, whistles, clicks, etc.*
- *NOTE 2: Keyboard, pen or touch user interfaces may contribute towards meeting this clause.*

2.7 Usage with limited manipulation or strength

- Where ICT requires manual actions, some users will need the ICT to provide features that enable users to make use of the ICT through alternative actions not requiring manipulation or hand strength.
- *NOTE 1: Examples of operations that users may not be able to perform include those that require fine motor control, path dependant gestures, pinching, twisting of the wrist, tight grasping, or simultaneous manual actions.*
- *NOTE 2: One-handed operation, sequential key entry and speech user interfaces may contribute towards meeting this clause.*
- *NOTE 3: Some users have limited hand strength and may not be able to achieve the level of strength to perform an operation. Alternative user interface solutions that do not require hand strength may contribute towards meeting this clause.*

2.8 Usage with limited reach

- Where ICT products are free-standing or installed, the operational elements will need to be within reach of all users.
- *NOTE: Considering the needs of wheelchair users and the range of user statures in the placing of operational elements of the user interface may contribute towards meeting this clause.*

2.9 Minimize photosensitive seizure triggers

- Where ICT provides visual modes of operation, some users need ICT to provide at least one mode of operation that minimizes the potential for triggering photosensitive seizures.
- *NOTE: Limiting the area and number of flashes per second may contribute towards meeting this clause.*

2.10 Usage with limited cognition

- Some users will need the ICT to provide features that make it simpler and easier to use.
- *NOTE 1: This clause is intended to include the needs of persons with limited cognitive, language and learning abilities.*
- *NOTE 2: Adjustable timings, error indication and suggestion, and a logical focus order are examples of design features that may contribute towards meeting this clause.*

2.11 Privacy

- Where ICT provides features that are provided for accessibility, some users will need their privacy to be maintained when using those ICT features that are provided for accessibility.
- *NOTE: Enabling the connection of personal headsets for private listening, not providing a spoken version of characters being masked and enabling user control of legal, financial and personal data are examples of design features that may contribute towards meeting this clause.*

Box B2: U.S. Rehabilitation Act of 1973. Section 508 Standards for Electronic and Information Technology - Subpart C — Functional Performance Criteria [245]

§ 1194.31 Functional performance criteria.

(a) At least one mode of operation and information retrieval that does not require user vision shall be provided, or support for assistive technology used by people who are blind or visually impaired shall be provided.

(b) At least one mode of operation and information retrieval that does not require visual acuity greater than 20/70 shall be provided in audio and enlarged print output working together or independently, or support for assistive technology used by people who are visually impaired shall be provided.

(c) At least one mode of operation and information retrieval that does not require user hearing shall be provided, or support for assistive technology used by people who are deaf or hard of hearing shall be provided.

(d) Where audio information is important for the use of a product, at least one mode of operation and information retrieval shall be provided in an enhanced auditory fashion, or support for assistive hearing devices shall be provided.

(e) At least one mode of operation and information retrieval that does not require user speech shall be provided, or support for assistive technology used by people with disabilities shall be provided.

(f) At least one mode of operation and information retrieval that does not require fine motor control or simultaneous actions and that is operable with limited reach and strength shall be provided.

Annex C: Example of product accessibility template

The following example product accessibility template may be attached to the Call for Tender for completion by the supplier.[246] To the greatest extent possible the format of any such template should be based on a similar template used in other regions for use with the standards cited in Annex B. The following example is based on the "Government Product Accessibility Template" provided by the Buy Accessible Wizard at http://buyaccessible.gov

The template should include, at a minimum,

- A clear reference to the procurement competition for which it is to be used
- A clear reference to the subject matter of the procurement
- A clear reference to the standard from which the accessibility requirements are taken
- The entire list of relevant accessibility requirements taken from the standards included in Annex B which are relevant for this procurement.

←--- Example template starts here ----→

Product accessibility for [*name of competition and ICT to be procured*]

Summary table: This table provides a summary of all the relevant sections from the standard [name of standard in Annex B from which provisions are taken]

- Column one includes all the sections of the standard that may apply to any deliverable. The total number of provisions within each Section of the Standard is shown in parentheses.
- Column two identifies the total number of provisions that typically apply to a deliverable of this type. Some of these may not be features of the supplier's deliverable. Conversely, others not noted may be features of the supplier's deliverable. If the deliverable includes additional features, the accessibility of these features must also be considered.
- Column three is for general notes about the sections of the standard. Some apply to all deliverables and some are specific to the deliverable.
- Column four is a summary of the vendor's response to applicable provisions and additional deliverable features from the sections of the standard.
- Column five is where the vendor can note explanations for any of the preceding columns, e.g. there are differences between expected applicable provisions and actual product features.

[246] It is based on similar templates provided by the Buyaccessible.gov wizard based on the US Section 508 procurement rules (cited in Annex B). A similar approach is encouraged by the European Mandate 376 technical reports. The European Mandate 376 process led to the development of the EN 301 549 standard referenced in this module.

[e.g. *Section 508, EN 301 549*] Standard Sections	Total Number of Applicable Provisions	Notes	Total Number of Supported Provisions			Please explain
			Fully	Partial	Not	
Section [*XX.xx*] [Name of section] ([*Number of*] provisions)	[*Number*]					
Section [*XX.xx*] [Name of section] ([*Number of*] provisions)	[*Number*]					
etc	etc					

Subpart B -- Technical Standards

Note: If there is a possibility that the provision applies, the default value is "Yes".

Provision Text	Applicable	Notes	How does the EIT meet this requirement?	Please explain
[*Accessibility requirement taken from standard cited in Annex B – to be filled in by the supplier*]	[Yes/No – to be filled in by procuring authority]		__Fully __Partially __No [to be filled in by supplier]	[to be filled in by supplier]
[*Accessibility requirement taken from standard cited in Annex B*]	[*Yes/No*]		__Fully __Partially __No	
[*Accessibility requirement taken from standard cited in Annex B*]	[*Yes/No*]		__Fully __Partially __No	

Annex D: Training materials and resources for use in awareness raising, capacity building and training in public procurement of accessible ICT

Training resources

ITU, 2009. "Public Procurement of Accessible ICTs - Training Workshop Presentation". Available at: www.itu.int/en/ITU-D/Digital-Inclusion/Persons-with-Disabilities/Pages/Resources.aspx

National Disability Authority of Ireland, 2012. "Disability Equality Training for Public Service Staff". Online training module available at http://elearning.nda.ie

CEN, CENELEC, ETSI, 2013. "European Accessibility Requirements for Public Procurement of Products and Services in the ICT Domain, (European Commission Standardization Mandate M 376, Phase 2)". A range of reports on developing an accessible ICT procurement Toolkit. Available at www.mandate376. Reports of most relevance are:

- D5: Draft "Online Procurement Toolkit for accessible ICT products and services").
- D6: Draft "Additional guidance and support material for the procurement of accessible ICT products and services").

Available at: www.mandate376.eu/pc.htm#pc1

CEN Workshop Agreement (CWA) 16266 "Curriculum for training ICT Professionals in Universal Design". Available at ftp://ftp.cen.eu/CEN/Sectors/TCandWorkshops/Workshops/CWA16266.pdf

Accessible ICT Procurement Toolkits:

Universal Design in Public Procurement (Norway)

Name: Universal Design in Public Procurement - Toolbox for buyers in the public sector.

Organization: Joint project between Bergen County, Bergen and pilot municipalities Time / Klepp.

Country: Norway

Year of publication (estimate): Autumn 2008

URL: www.universelleanskaffelser.no/

The toolbox for call-for-tenders (Denmark)

Name: Udbudsværktøjskassen (the toolbox for call-for-tenders)

Organization: IT- og Telestyrelsen (National IT and Telecom Agency)

Country: Denmark

Year of publication: 2004, updated December 2009

URL: http://vkassen.itst.dk/

IT Procurement Toolkit (Ireland)

Organization: Centre for Excellence in Universal Design at the National Disability Authority (NDA)

Year of publication : February 2007

URL: www.universaldesign.ie/useandsupply/ict/itprocurementtoolkit

BuyAccessible Wizard (USA)

Name: BuyAccessible Wizard

Organization: General Services Administration (GSA)

Country:USA

Year of publication (estimate): 2004 (Updates ongoing)

URL: https://app.buyaccessible.gov/baw/

Accessible Procurement Toolkit (Canada)

Name: Accessible Procurement Toolkit

Organization: Industry Canada (ic.gc.ca)

Country: Canada

Year of publication (estimate):

URL: www.apt.gc.ca/

International Telecommunication Union (ITU)
Telecommunication Development Bureau (BDT)
Office of the Director
Place des Nations
CH-1211 Geneva 20 – Switzerland
Email: bdtdirector@itu.int
Tel.: +41 22 730 5035/5435
Fax: +41 22 730 5484

Deputy to the Director and Director, Administration and Operations Coordination Department (DDR)
Email: bdtdeputydir@itu.int
Tel.: +41 22 730 5784
Fax: +41 22 730 5484

Infrastructure Enabling Environmnent and e-Applications Department (IEE)
Email: bdtiee@itu.int
Tel.: +41 22 730 5421
Fax: +41 22 730 5484

Innovation and Partnership Department (IP)
Email: bdtip@itu.int
Tel.: +41 22 730 5900
Fax: +41 22 730 5484

Project Support and Knowledge Management Department (PKM)
Email: bdtpkm@itu.int
Tel.: +41 22 730 5447
Fax: +41 22 730 5484

Africa

Ethiopia
International Telecommunication Union (ITU)
Regional Office
P.O. Box 60 005
Gambia Rd., Leghar ETC Building
3rd floor
Addis Ababa – Ethiopia

Email: itu-addis@itu.int
Tel.: +251 11 551 4977
Tel.: +251 11 551 4855
Tel.: +251 11 551 8328
Fax: +251 11 551 7299

Cameroon
Union internationale des télécommunications (UIT)
Bureau de zone
Immeuble CAMPOST, 3e étage
Boulevard du 20 mai
Boîte postale 11017
Yaoundé – Cameroon

Email: itu-yaounde@itu.int
Tel.: + 237 22 22 9292
Tel.: + 237 22 22 9291
Fax: + 237 22 22 9297

Senegal
Union internationale des télécommunications (UIT)
Bureau de zone
19, Rue Parchappe x Amadou Assane Ndoye
Immeuble Fayçal, 4e étage
B.P. 50202 Dakar RP
Dakar – Senegal

Email: itu-dakar@itu.int
Tel.: +221 33 849 7720
Fax: +221 33 822 8013

Zimbabwe
International Telecommunication Union (ITU)
Area Office
TelOne Centre for Learning
Corner Samora Machel and Hampton Road
P.O. Box BE 792 Belvedere
Harare – Zimbabwe

Email: itu-harare@itu.int
Tel.: +263 4 77 5939
Tel.: +263 4 77 5941
Fax: +263 4 77 1257

Americas

Brazil
União Internacional de Telecomunicações (UIT)
Regional Office
SAUS Quadra 06, Bloco "E"
11º andar, Ala Sul
Ed. Luis Eduardo Magalhães (Anatel)
70070-940 Brasilia, DF – Brazil

Email: itubrasilia@itu.int
Tel.: +55 61 2312 2730-1
Tel.: +55 61 2312 2733-5
Fax: +55 61 2312 2738

Barbados
International Telecommunication Union (ITU)
Area Office
United Nations House
Marine Gardens
Hastings, Christ Church
P.O. Box 1047
Bridgetown – Barbados

Email: itubridgetown@itu.int
Tel.: +1 246 431 0343/4
Fax: +1 246 437 7403

Chile
Unión Internacional de Telecomunicaciones (UIT)
Oficina de Representación de Área
Merced 753, Piso 4
Casilla 50484, Plaza de Armas
Santiago de Chile – Chile

Email: itusantiago@itu.int
Tel.: +56 2 632 6134/6147
Fax: +56 2 632 6154

Honduras
Unión Internacional de Telecomunicaciones (UIT)
Oficina de Representación de Área
Colonia Palmira, Avenida Brasil
Ed. COMTELCA/UIT, 4.º piso
P.O. Box 976
Tegucigalpa – Honduras

Email: itutegucigalpa@itu.int
Tel.: +504 22 201 074
Fax: +504 22 201 075

Arab States

Egypt
International Telecommunication Union (ITU)
Regional Office
Smart Village, Building B 147, 3rd floor
Km 28 Cairo – Alexandria Desert Road
Giza Governorate
Cairo – Egypt

Email: itucairo@itu.int
Tel.: +202 3537 1777
Fax: +202 3537 1888

Asia and the Pacific

Thailand
International Telecommunication Union (ITU)
Regional Office
Thailand Post Training Center, 5th floor,
111 Chaengwattana Road, Laksi
Bangkok 10210 – Thailand

Mailing address
P.O. Box 178, Laksi Post Office
Laksi, Bangkok 10210 – Thailand

Email: itubangkok@itu.int
Tel.: +66 2 575 0055
Fax: +66 2 575 3507

Indonesia
International Telecommunication Union (ITU)
Area Office
Sapta Pesona Building, 13th floor
Jl. Merdan Merdeka Barat No. 17
Jakarta 10001 – Indonesia

Mailing address:
c/o UNDP – P.O. Box 2338
Jakarta 10001 – Indonesia

Email: itujakarta@itu.int
Tel.: +62 21 381 3572
Tel.: +62 21 380 2322
Tel.: +62 21 380 2324
Fax: +62 21 389 05521

CIS countries

Russian Federation
International Telecommunication Union (ITU)
Area Office
4, Building 1
Sergiy Radonezhsky Str.
Moscow 105120
Russian Federation

Mailing address:
P.O. Box 25 – Moscow 105120
Russian Federation

Email: itumoskow@itu.int
Tel.: +7 495 926 6070
Fax: +7 495 926 6073

Europe

Switzerland
International Telecommunication Union (ITU)
Telecommunication Development Bureau (BDT)
Europe Unit (EUR)
Place des Nations
CH-1211 Geneva 20 – Switzerland
Switzerland
Email: eurregion@itu.int
Tel.: +41 22 730 5111

International Telecommunication Union
Telecommunication Development Bureau
Place des Nations
CH-1211 Geneva 20
Switzerland
www.itu.int

ISBN 978-92-61-19921-0

9 789261 199210

Printed in Switzerland
Geneva, 2014

11/2014

GSR discussion paper

M-services and applications: Perspectives on regulatory measures to foster diffusion and access

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 25 June 2015.

The views expressed in this paper are those of the authors and do not necessarily reflect the opinions of ITU or its Membership.

"The world was so recent that many things lacked names, and in order to indicate them it was necessary to point."

Gabriel Garcia Marquez[1]
One Hundred Years of Solitude

Table of Contents

Page

1. Executive summary 3

2. Introduction 4

3. Welcome to the digital ecosystem 4

3.1 What are m-services and applications? 4

3.2 Sector Growth 6

3.3 Drivers for diffusion and access of m-services and apps 7

3.4 Emerging concerns 10

4. Policy and Regulatory Perspectives 10

4.1 Goals of Regulation 11

4.1.1 Competition for consumer benefit 15

4.1.2 Stimulating demand – Universal access 17

4.1.3 Pressure for resources 18

4.1.4 Protecting the Consumer 21

4.1.5 Infrastructure sharing 25

4.1.6 Trust and confidence 26

4.1.7 Regulating in a multi-sectoral environment 26

5. Emergence of rights-based regulatory approaches and statutory recognition 32

6. Setting new regulatory objectives 34

7. LIST OF ACRONYMS 36

©ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

[1] Colombian novelist, short-story writer, screenwriter and journalist (March 1927 – 17 April 2014)

M-services and applications: Perspectives on regulatory measures to foster diffusion and access

Authors: Mercy Wanjau, Assistant Director, Communications Authority of Kenya

1. Executive summary

Mobile services and applications are playing a prominent role within the broader digital ecosystem to unlock economic opportunities and avail critical services to citizens. As consumer demands are placed on it, disruptive technologies and innovation are enabling it to continue bringing about new possibilities in the future. Governments, Regulators–consumers and indeed the world – are only beginning to understand the true development potential of mobile services and applications. Despite this, a few elements are emerging:

One, the old telecom rules of engagement may not stand the test of time and some aspects may need to be re-written to address the changing environment. More so, there is a need to depart from rigid rules to a light touch approach for the regulatory framework to be more responsive to the innovative ecosystem of m-services and apps. The regulatory scope of principles of competition, universal service, resource allocation, interoperability and standards among others need to be reviewed.

Two, sector regulators have been thrust into a multi- sectoral space due to the cross cutting nature of disruptive innovation. This has broadened their domain and capacity to influence across sectors – but to do so, they must reach out and collaborate proactively more than reactively going forward. In addition, the multi-sectoral entry has brought in new stakeholders which the sector regulator needs to identify and engage in order to leverage for mutual benefit.

Three, a flexible, transparent approach that promotes competition will allow innovation to thrive, provide incentive for investment and ultimately consumer benefit. Greater consideration is therefore required in the development of regulatory frameworks that will govern the growth of the digital ecosystem in order to ensure that it continues to surprise the world and stretch the imagination with new ideas and innovations.

For this to happen, the regulator needs to adopt a delicate balance as it has long been recognized that regulation can have an impact on innovation, both positively and negatively. The awareness to foster the inter-dependencies necessary to enable the digital ecosystem to evolve into a healthy environment that creates economic value and adds well being to society on one hand and to deter and punish discordant players on the other will require a resolute approach and stakeholder support. Otherwise, innovation can tend to take a backseat when straddled by complex issues and uncertain rules.

This paper seeks to explore regulatory perspectives that can be considered in facilitating use and access and in so doing, re-viewing regulatory constructs that have become barriers over

time. It proposes that efforts must be made to place the consumer at the center of the digital ecosystem by installing consumer safeguards. The paper encourages regulatory approaches that will ensure there is a balanced, proportionate and robust mechanism for players in the digital economy to flourish so that development goals can be realized. In this way, m-services and apps will leverage on the phenomenal growth of mobile and the fact that this powerful technology is available in most rural and remote areas, empowering development in areas such as healthcare, education, agriculture, commerce, banking and so on.

The purpose of this paper is to make a contribution to the efforts and discussions that continue to guide and shape the continued re-definition of regulatory architecture towards the establishment of an empowering digital future.

2. Introduction

We are living in the midst of a social, economic, and technological revolution. How we communicate, learn, socialize and conduct business has moved beyond the narrow confines of language and geographical proximity and onto the Internet. The Internet has in turn moved into our phones, device, homes and cities, and it continues to wield profound influence on civic, commercial and social engagements in society.

One of the outcomes is an explosion of data that is bringing about numerous insights that are changing our world[2]. A study conducted in 2013 found that the impact of the mobile sector on other industries such as energy, health and financial was so profound to the extent that it could fundamentally change how those vertical segment operate[3]. These top three categories have encountered the most disruption – questioning the efficacy of conventional models of doing business.

3. Welcome to the digital ecosystem

3.1 What are m-services and applications?

The mobile platform is a fundamental part of the digital ecosystem. In the last two decades or so, it has played into the heart of the digital ecosystem with offerings on voice, data and increasing speeds of broadband. This mobile platform has been of great impact by bridging access gaps and progressively being used to deliver services to businesses and citizens alike. While there are several other players within the digital ecosystem, the objective of this

[2] If you think that you are suffering from information overload then you may be right – a new study by the University of Southern California shows that everyone is bombarded by the equivalent of 174 newspapers of data a day. Further, that every day the average person produces six newspapers worth of information compared with just two and a half pages 24 years ago – nearly a 200-fold increase. http://www.telegraph.co.uk/news/science/science-news/8316534/Welcome-to-the-information-age-174-newspapers-a-day.html (accessed on Feb.23, 2015).

[3] Chetan Sharma, Mobile 4th Wave: Evolution of the next trillion dollars, Mobile Future Forward, September 10, 2013, Seattle at page 7

paper is to discuss perspectives on regulatory strategies that can be adopted in facilitating diffusion and access of m-services and applications.

In building up this discussion, it is important to mention that m-services and apps are different with the latter riding on networks of the former. Indeed both can thrive on similar regulatory approaches to some extent. However, at some point each of these could call for differentiated regulatory intervention in order to establish an enabling environment. Given this context, this paper will approach the perspectives under discussion under the broad ambit of the digital ecosystem, and draw out distinctions, as necessary to illustrate regulatory strategies for fostering diffusion and access with reference to m-services and applications. Particular referencing will be made to m-payments and m-health to highlight specific issues.

The portability of mobile has promoted ease of access to the Internet and has made available conventional services such as banking, access to government services and education in regions where these services were either unavailable or inadequate. Governments are looking to this platform for innovative ways to improve the delivery of public services and to foster participation in public policy making throughout the world and particularly within the developing country context[4]. The unique characteristics heralded by the Golden age of Mobile enable efficiencies that continue to hold much promise and tremendous benefits for citizens, businesses and governments alike.

The interface between the Internet and devices, particularly portable ones, offers an attractive distribution platform on which multiple applications (more popularly referred to as apps) and services are offered to consumers. Initially, mobile apps were originally offered to enable general productivity and information retrieval, including email, calendar, contacts, stock market and weather information. However, public demand and the availability of developer tools drove rapid expansion into other categories, such as word processing, social media, picture sharing, mobile games, factory automation, GPS mapping and location-based services, banking, networking and file transfer, education, video streaming, order tracking, ticket purchases and more recently mobile medical apps and more. The popularity of mobile apps has continued to rise, as their usage has become increasingly prevalent across mobile phone users.

---

[4] See results of the United Nations Public Service Awards Winners 2014 available at : http://workspace.unpan.org/sites/Internet/Documents/2014%20UNPSA%20List%20of%20Winners.doc.pdf (Accessed on March 3, 2015).

Digital India is an initiative of Government of India to integrate the government departments and the people of India. It aims at ensuring the government services are made available to citizens electronically by reducing paperwork. The initiative also includes plan to connect rural areas with high-speed internet networks.

Box 1: A Mobile app

What is a mobile app?

A mobile app is a software program you can download and access directly using your phone or another mobile device, like a tablet or music player.

What do I need to download and use an app?

You need a smart phone or another mobile device with Internet access. Not all apps work on all mobile devices. Once you buy a device, you're committed to using the operating system and the type of apps that go with it. The Android, Apple, Microsoft and BlackBerry mobile operating systems have app stores online where you can look for, download, and install apps. Some online retailers also offer app stores. You'll have to use an app store that works with your device's operating system. To set up an account, you may have to provide a credit card number, especially if you're going to download an app that isn't free[5].

What is mobile for development?

Mobile for development is a broad term that captures initiatives that brings together mobile network operators (MNOs) and the development community to drive commercial mobile services for the benefit of underserved people in emerging markets. These initiatives are driven by the premise that mobile is the predominant infrastructure in emerging markets and seeks to identify opportunities for social, economic and environmental impact[6].

Apps are usually available through application distribution platforms typically operated by the owner of the mobile operating system. Usually, they are downloaded from the platform to a target device, such as an iPhone, BlackBerry, Android phone or Windows Phone, but sometimes they can be downloaded to laptops or desktop computers. Mobile applications usually help users by connecting them to Internet services more commonly accessed on tablets, smartphones or notebook computers, or help them by making it easier to use the Internet on their portable devices. But for these apps and services to be available, access to an ICT network is required.

3.2 Sector Growth

According to ITU statistics, the number of mobile-cellular subscriptions worldwide is approaching the number of people on earth – estimated at approximately 7 billion corresponding to a penetration rate of 97%, up from 738 million in 2000. Globally, it is estimated that 3.2 billion people are using the Internet of which 2 billion are from developing countries.

[5] https://www.consumer.ftc.gov/articles/0018-understanding-mobile-apps (Accessed on May 18, 2015)

[6] http://www.gsma.com/mobilefordevelopment/overview (Accessed on May 18, 2015)

The statistics also indicated that mobile broadband is the most dynamic market segment with a penetration reach of 47% in 2015- a value that has increased 12 times since 2007. The fixed-broadband uptake was found to have grown at a slower pace, with a 7% annual increase over the past three years and was expected to reach an 11% penetration by the end of 2015.The proportion of the population covered by a 2G mobile-cellular network grew from 58% in 2001 to 95% in 2015. During the same period, 3G mobile-broadband coverage was extending rapidly and into the rural areas[7].

Looking towards the future, the mobile networks will play an even more significant role in the post 2015 development agenda. This opportunity will arise through use of the networks as leverage for the diffusion of m-services and applications. As countries continue to make positive interventions such as upgrading of mobile networks, deployment of 3G+ technologies and adoption of more enabling regulatory policies and practices, it is expected that broadband and mobile devices will become more affordable and thereby stimulate the development of the digital ecosystem.

> The use of modern information and communications technology continues to grow—with slightly over three billion people online and seven billion mobile-cellular subscriptions

3.3 Drivers for diffusion and access of m-services and apps

Commitment to digital inclusion

The entry of ICTs to enable the achievement of development goals has introduced a new matrix and strengthened the case for the "social inclusion" objective to include broadband connectivity, telephony service coverage, and Internet access, aimed at small and medium-sized rural communities and the urban poor. The increasing use of applications to deliver civic services, health, education and drive businesses and commerce means that there is need for commitment to digital inclusion. This will drive the articulation of coherent and comprehensive national broadband plans in order to achieve the intended benefits[8]. There is

[7] ITU ICT Facts & Figures 2015. Available at: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf (Accessed on June 2, 2015)

[8] Robert Frieden, "Lessons from Broadband Deployment in Canada, Japan, Korea and the United States" Telecommunications Policy 2005 at Page 9.

no one size fits all[9]. According to the OECD, as broadband technology continues to improve and bandwidth increases, the capacity for broadband to act as an enabler of structural change in the economy will expand due to its impact on an increasing number of sectors and activities[10].

Box 2: Karnataka app M-One

Karnataka state in India launched its ambitious mobile governance project on December 10, 2014. It is the first of its kind in the country that allows. M-One, which will act as a single window to 637 services offered by the government, both central and state, but more importantly, link the consumer to 3,644 private services at one touch.[11]. The platform has a voice portal that can be accessed through any phone - landline or mobile - and also via computers, laptops, tablets.

The mobile app allows citizens to pay utility bills for electricity, pay property tax, apply for a host of services like driving license, passport or PAN, pay up for traffic challans, book tickets on rail and road transport, among others. People can even lodge complaints with civic authorities about garbage strewn around, and a women's safety app is something the government is taking pride to give to women citizens. The app has features that allow citizens to access many of these services even without a smart phone. Over 3500 services related to healthcare, transport are also available on the same platform.

The platform has a voice portal that can be accessed through any phone - landline or mobile - and also via computers, laptops, tablets. Consumers can call in and work through the interactive voice response system, send SMS, or use the services via the smartphone app for Android or Apple devices. All local languages and English will work. The project was devised by Karnataka's e-governance department in January 2013 under

[9] Some countries choose to have one policy for universal service and re-define universal standards to include broadband. Others have a policy for universal access and another for broadband deployment. Still others subscribe a general target for access nationally while others differentiate from region to region. In Malaysia, for example, broadband and universal service policies are separate, and levels of access are terraced by region.

[10] http://broadbandtoolkit.org/4.2

[11] http://ibnlive.in.com/news/karnataka-launches-m-one-app-citizens-can-access-637-government-services/517116-62-129.html (Accessed on May 4, 2015)

the BJP government. The platform seeks to ensure that "Whatever is accessible on the computer to the urbanite will now be available to everyone, including those in remote areas and those who are travelling, at their fingertips."

Mobile phone penetration in India, according to a June survey by TRAI[12], the telecom regulator, is 942.9 million. In Karnataka, 55 million of its 64 million population own mobile phones. This is way more than the personal computer penetration, which is an estimated 10% of India's 1.25 billion population. Karnataka is working on integrating a pre-paid mobile wallet with the app, which will allow citizens to pay for any services - including payment of utility bills, taxes - with one touch.

Competition

The progressive reliance on competition as the primary driver of consumer benefits has spurred significant economic growth in many countries. For example, in 2014, mobile services added 3.2% ($548 billion) to the United Stated GDP, exceeding the contributions to GDP of a number of other industries including entertainment, transportation, automobile, hospitality and agriculture[13]. Adopting strategies for robust competition has brought about lower prices, improved quality, greater innovation and diversity in consumer choice.

The rapid expansion of fixed and mobile broadband services and the drop in broadband prices have been major drivers of the information society. The biggest drop has occurred in developing countries – thereby widening possibility for affordability and access to m-services and apps[14]. High-speed Internet access usage has continued to increase as broadband prices fall and mobile broadband networks expand rapidly. Almost all countries in the world have launched at least third generation (3G) mobile-broadband services, and the number of subscriptions has been growing rapidly. It is anticipated that by the end of 2014, there will be 32 mobile-broadband subscriptions per 100 inhabitants globally, almost double the penetration rate in 2011[15].

Access to big data

Today, data is more deeply woven into the fabric of our lives than ever before. The data can be used to anticipate and solve problems, improve well-being, and generate economic prosperity. The collection, storage, and analysis of data is on an upward and seemingly unbounded trajectory, fueled by increases in processing power, the cratering costs of computation and storage, and the growing number of sensor technologies embedded in devices of all kinds[16]. Data collection and handling - data aggregation and analysis bring out new insights that are informing monetization opportunities in the mobile ecosystem.

---

[12] http://www.trai.gov.in

[13] United States Federal Communications Commission contribution to the 2015 Global Symposium for Regulators Consultation.

[14] Measuring the Information Society Report, 2014

[15] Ibid.

[16] Big data: Seizing opportunities, preserving values, Executive Office of the President, May 2014 https://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pd (Accessed on May 13, 2015)

3.4 Emerging concerns

The growing diffusion of mobile services and applications within the broader framework of the digital ecosystem also raises concerns that need to be addressed in order for the digital ecosystem to sustain. To start with, increased adoption of the digital inclusion agenda will mean isolation of populations that have no access to m-services and apps. How is a regulator to respond and ensure that the benefits of social inclusion are enjoyed by its citizens?

While competition has spurred consumer choice and enhanced their benefits, the regulatory concern remains: Is competition being encouraged adequately? Are there any competition concerns? Where meaningful competition lacks, are there timely interventions being put in place to support universal service? Are regulatory principles in place to encourage and incentivize investment and innovation into the digital ecosystem?

Undeniably, the markets continue to become more complex. Mobile network operators (MNOs) have become the custodians of sensitive data within the digital ecosystem and this has brought about privacy concerns related to consumers' use of mobile technology[17]. Are consumer able to make informed decisions about their information and privacy and to ensure that user privacy is respected and protected by those designing and building mobile applications? The concern as to whether consumers are well supported to make informed choices in an increasingly complex market place becomes valid.

There are broader concerns as m-services and apps are increasingly vulnerable to security concerns with networks worldwide falling victim to hacking by cyber criminals. Cases of fraud, misuse of data and use of mobile phones as an accessory in the commission of crimes are on the increase. The impact of this can lower trust and confidence in the digital ecosystem.

These concerns raise weighty issues and call for a thoughtful consideration of policy and regulatory action going forward. While there is a need to protect personal freedoms, it is important to do so in a manner that does not hamper the ability to innovate around an opportunity. It is important to uphold trust and confidence in the digital ecosystem and take active steps to mitigate the emerging concerns, if the gains are to be made. Regulators therefore need to consider whether the policy and regulatory framework is fit for purpose – to ensure the achievement of a delicate balance for m-services and apps to thrive within the digital economy.

4. Policy and Regulatory Perspectives

This part of the paper seeks to highlight policy and regulatory perspectives that can be considered in promoting growth of m-services and apps while at the same time ensuring that innovation is not stifled and that consumer benefits are maximized. In doing so, this section will identify critical regulatory principles that should be addressed and offer

[17] Big data: Opportunity or thereat? B Andrew Haire & others, GSR 2014 Discussion Paper. Available at: http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2014/Discussion%20papers%20and%20presentations%20-%20GSR14/Session3_GSR14-DiscussionPaper-BigData.pdf (Accessed on March 27, 2015)

perspectives for leveraging the anticipated benefits against the risks. The perspectives shared in this part will contribute to a series of critical questions that policy makers and regulators can use as a guide in making considerations on proposals seeking to foster m-services and apps.

4.1 Goals of Regulation

The ICT regulatory framework was conceptualized to guide structural changes as the sector transitioned from monopoly to competition and thereafter to promote effective competition and foster the long-term development of the ICT market[18]. The sector has undergone structural changes pushed by convergence and innovation and needs to be flexible to accommodate any reviews as necessary. The regulator will need to ask some critical questions to enable identify an ideal option for regulating.

Regulation is not intended to serve as an end in itself as illustrated below.

Box 3: Regulation

Source: Telecommunications Management Group, Inc.

[18] www.ictregulationtoolkit.org /6.2

Are there limitations in the current regulatory regime?

While the conventional regulatory framework is necessary to resolve disputes, address competition concerns, protect consumers, and attain national goals such as universal access and economic development, it can also become a bottleneck to innovation and investment if it fails to respond to the issues of the day. The apparent need to adopt regulatory mechanisms within a cross-sectoral framework is a critical interdependency for m-services and applications to thrive within the digital ecosystem. However, this was not anticipated within the conventional 'silo' sector regulatory arrangements. It therefore calls for a paradigm shift to permit a new way of doing things.

It is a daunting task for regulators to identify the right regulatory approach within a fast changing environment where services and applications evolve faster than the regulations that underpin them[19]. However, it would be advisable to identify the objective of regulation before articulating a framework to avoid unnecessary regulation. Innovation cannot thrive within a formal confinement of rules.

The regulatory approach to be used is equally important once the object of regulation has been identified. In the early stages, formal heavy prescription was adopted as new rules, rights and obligations were being imposed. However, the general evolution has tended towards a light touch approach to encourage and foster m-services and applications by giving room to embrace ideas that were not anticipated earlier.

It calls for a delicate balancing act.

The evolution of the M-Pesa mobile money transfer service is a classic case in illustrating how a paradigm shift was employed to overcome traditional regulatory arrangements in order to enable the entry of an innovative m-service. Cross-sectoral regulatory forbearance was applied to deal with an innovation that was not anticipated and hence not accommodated by both the telecom and the financial sectors that it straddled. It brought forth a light touch regulatory approach at the launch of the transfer service - gradual introduction of payment systems regulation for better financial oversight on one hand and the requirement for interoperability between the Safaricom network with the other networks to foster competition.

[19] Ibid. See Creating the "right" enabling environment for ICT (Guermazi & Satola)

Box 4: M-Pesa

M-Pesa, used in Kenya is one of the world's most successful mobile money transfer service. It was launched in 2007 by Safaricom, Kenya's largest MNO. Through it, millions of people who have access to a mobile phone, but do not have or have only limited access to a bank account, to send and receive money, top-up airtime and make bill payments.

Customers register for the service at an authorized agent, often this is a small mobile phone store or retailer, and then deposit cash in exchange for electronic money which they can send to their family or friends. Once they have registered, all transactions are completed securely by entering a PIN number and both parties receive an SMS confirming the amount that has been transferred. The recipient, who does not have to use the same network, receives the electronic money in real-time and then redeems it for cash by visiting another agent.

There are several mobile money schemes established world-wide. Why has m-pesa been the most successful?

Some of the concerns worth noting in the consideration of this unprecedented proposal were:

- The unique model was being led by non-banking entities that were regulated under a different regime.
- Due to the cross cutting nature of this model, which institution was best placed to regulate? Was this a platform to collaborate?
- The novelty of the proposition meant that there was no precedent to draw from.
- Despite the promise to meet a great need, it was imperative to put in place consumer protection mechanisms in order to inspire confidence.
- Any guidelines to be developed needed to be flexible in order to accommodate new changes and not confine the development of new services.
- There was need to ensure that a level playing field was maintained in the telecommunication industry and be sensitive to any competition concerns.

The financial sector regulator, Central Bank of Kenya (CBK), the telecom Regulator (then CCK now the Communications Authority) and the Ministry of Finance conducted a due diligence to assess associated risks before commissioning the project. CBK put in place minimum KYC standards to promote trust and confidence in the payment system hence promoting consumer welfare. It also gave a special license to Safaricom that contained less stringent conditions as compared to licenses given to banks and other financial institutions. The regulators' initial decision to allow the

scheme to proceed on an experimental basis without a formalized regulatory framework was the root of this success.

The exercise of regulatory forbearance allowed innovation to thrive without being 'boxed in' by conventional practices. Having established a base of initial users, M-pesa enjoyed the network effects of being hosted by the largest MNO. The more people signed up for it, the more it made sense for others to do so.

While regulatory forbearance was exercised in the inception stages in order to encourage innovation and uptake, a measure of formal prescription has been adopted over time to provide for formal oversight over payment systems and prescribe anti-money laundering measures. The National Payment Systems Regulations became law in August, 2014.

The M-pesa agency system initially operated within the Safaricom network only and is now interoperable with other networks. The accommodation for interoperability came in the wake of a petition by Airtel to the CAK to compel Safaricom to open up its M-pesa agency network.

M-pesa has made a contribution to financial inclusion in Kenya and enjoys the patronage of over 20 million subscribers currently.

Source: Author.

To license or to exempt?

The regulatory goals being pursued have a direct bearing on the licensing approach that is adopted. Previously, the construct adopted rigid service and technology specific licenses that were often installed as an administrative catchment for revenue. Regulators are encouraged to adopt more flexible licensing regimes in order to accommodate technological and market changes. The convergence achieved within the digital ecosystem has eroded aspects of the traditional licensing regimes hence the need to move from technology and service specific licenses and yield to a unified authorization regime, or simple notifications in order to promote the ease of doing business[20]. In so doing, the license or notification is retained to achieve regulatory accountability without being a barrier to new innovations.

Maintaining the traditional licensing regime would mean that not only would an MNO obtain a license to operate mobile services, they would also have to obtain a value added services license for each and every m-service and app operating on its network. Having to obtain licenses from healthcare, education, financial, agriculture regulators etc. would not only be a highly cumbersome, it would severely restrict the diffusion of m-services and apps. Regulators therefore need to regularly review their licensing practices and approaches with a view to identifying and removing potential barriers.

[20] http://www.ictregulationtoolkit.org/3.8.1.2 Licensing for Converged and Next Generation Networks

4.1.1 Competition for consumer benefit

New technical capabilities made possible by IP-based broadband networks have given rise to new entrants competing in traditional markets with new business models and completely different cost structures than traditional providers. New technologies and upgraded networks have also enabled the introduction of a wide variety of new services and applications. What are the impacts of these changes on the competitive environment?

The emerging scenario introduces regulatory complexity and the need to address several principles that are critical in promotion of competition[21].

These questions are particularly valid in a market with dominant operators due to their ability to skew the markets and abuse their dominant positions to the detriment of their competitors and customer base. As mobile markets continue to become more competitive the regulator should be alert for the many ways in which dominant operators can engage in anticompetitive behavior (*e.g.*, predatory pricing, cross-subsidization, price discrimination, discriminatory provisioning of network facilities, overpricing of essential facilities and other network elements and services provided to competitors, unfair trade practices, tie-in sales, and anticompetitive bundling).

One of the more likely outcomes is that an m-service or app that rides on a large network will ultimately be a beneficiary of the network effects, much to the discomfort of other operators in the same market. This happened in Kenya when Airtel money which operates the second biggest mobile money platform in Kenya petitioned the Competition Authority of Kenya (CAK) to investigate Safaricom for alleged abuse of its position as the market leader in M-commerce in Kenya[22].

Airtel Kenya had claimed that Safaricom's charges to its customers when sending money to Airtel Money accounts was double the amount of that required for Safaricom-to-Safaricom transactions. Airtel Kenya also wanted Safaricom to allow M-pesa agents to deal with other agents like Yu money, Airtel money and Mobikash[23]. In a demonstration of regulation in a multi-sectoral space and regulatory forbearance, the CAK deferred the issue to the Central Bank of Kenya (CBK) and the Communications Authority of Kenya (CA).

In July 2014, the CA ordered Safaricom to allow its mobile money agents to also operate other platforms. The CA further recommended that the CBK handle the petition on M-pesa tariffs as

---

[21] GSR Discussion Paper (2014): Why competition matters and how to foster it in a dynamic ICT sector. Hernandez et al. Available at: http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2014/Discussion%20papers%20and%20presentations%20-%20GSR14/Session%202%20GSR14%20-%20Discussion%20paper%20-%20Competition.pd (Accessed on May 20, 2015)

[22] Safaricom ordered to open M-Pesa platform. Available at: http://www.kbc.co.ke/safaricom-ordered-to-open-m-pesa-platform/ (Accessed on June 1, 2015)

[23] Ibid.

these were charges for financial services[24]. The M-pesa agency system initially operated within the Safaricom network only and is now interoperable with other networks.

The scenario just described raises several perspectives on issues to consider when regulating to foster diffusion of m-services and apps. It indicates that assessment of competition concerns in the digital economy requires an 'in-depth' investigation to evaluate the 'pain point' being raised. It is clear that a restrictive arrangement does arise when an m-service is locked to an MNO or an app to an operating system and this has the potential to raise competition concerns. The 'lock-in' effect has spurred discussions for platform agnosticism and the creation of an open mobile app. This was provoked by considerations for free sharing to the mass market of content thought to be critical in achievement of development goals, such as m-Learning content, as well as dissemination of commercial resources in order to achieve development goals[25].

- Some of the perspectives can be clarified through asking questions such as these:
- Are the regulatory arrangements for infrastructure sharing adequate to achieve goals for national access?
- Are the exclusive arrangements governing m-services and apps riding on MNOs and operating systems raising competition concerns?
- What is the impact of these exclusive arrangements on pricing? Are the tariffs fair and non-discriminative?

Have all relevant stakeholders in this issue been identified and consulted widely for input?

Answers to these questions will guide on appropriate regulatory interventions to take in order not to entrench anticompetitive features unwittingly. They will guide on considerations to be made when setting parameters for pricing as the cost of sending a text message or purchasing an app will ultimately determine the affordability and access to the m-service or app. As such regulators must ensure that the interconnection framework is clearly defined and that interconnection charges between networks are based on objective, economically sound, and solidly substantiated costs.

It is also apparent that in aiming for a robust competitive environment, the telecom construct for competition regulation may be inadequate to handle the brief. It is therefore incumbent upon regulators to put in place appropriate safeguards and interventions to leverage opportunities in the digital ecosystem. Introduction of number portability, interoperability and sharing of infrastructure are other mechanisms that could also be considered. These safeguards will be discussed further on in this paper.

---

[24] Ibid.

[25] M-Powering Development Initiative Report 2015 at page 14. Available at: http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Documents/m-PoweringDevelopmentInitiative_Report2015.pdf (Accessed on May 28, 2015)

4.1.2 Stimulating demand – Universal access

The network reach and smartness of infrastructure to support access to m- services and apps remains on the regulator's radar now more than ever before. The urgency to bridge gaps compels new ideas and creativity in order to identify optimal strategies for achievement of universal service.

Traditionally, efforts to address access gaps were directed to deployment and improvement of telecommunications infrastructure access networks only. Today, it calls for a more integrated multi-sectoral approach. It is about expanding the network to include broadband services, but within a broader outlook to stimulate the development of content that is relevant in context and language and in this way foster the development of m-services and apps[26].

This would also mean that national broadband plans can no longer be perceived as deliverables within the sector only. The roll out of mobile networks and broadband enablement would need to be construed in a holistic manner, beyond the ICT sector horizon in order to enable other actors to leverage on the broadband network and make a significant contribution in the march towards universality[27]. This would avoid vertical 'silo' interventions and enable identification of where m-services and apps can 'plug-in' in an integrated and interoperable manner with already existing systems and solutions.

This broad approach would provide financing mechanisms to accommodate local content development, application development, incubation, scaling and monetization as well as provision of support in development of mechanisms to protect content to allow for exploitation for commercial gain. It would also prompt a radical re-thinking around the nature of universal service obligations imposed on service providers[28].

The Broadband Commission has set ambitious goals to make broadband policies universal in order to drive prices down and make it affordable[29]. Drawing from international commitments such as this prompts urgency for regulators to articulate an integrated national approach. There is no one size fits all solution. Each country must quantify the unique hurdles to be overcome, the resources and investment required, and it must develop a comprehensive plan at the national level in relation to the size of the gaps to be bridged.

---

[26] M-Powering Development Initiative Report 2015 at page xi. Available at: http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Documents/m-PoweringDevelopmentInitiative_Report2015.pdf (Accessed on May 28, 2015)

[27] See example of The National Broadband Strategy for Kenya. Available at : http://ca.go.ke/images//downloads/PUBLICATIONS/NATIONAL%20BROADBAND%20STRATEGY/National%20Broadband%20Strategy.pdf (Accessed on May 18, 2015)

[28] This framework should not be limited to the creation of a Universal Service Fund and should be open to other mechanisms such as internal cross-subsidies, public-private partnerships (PPPs), pay or play mechanisms, General Government Budget Contributions/Grants, Interconnection Surcharges a Municipal network alternatives and other funding approaches.

[29] http://www.broadbandcommission.org/Documents/Broadband_Targets.pdf (Accessed on May 20, 2015)

In the health sector, for example different countries have adopted varied focus points in the development of m-health applications in response to the health needs of their populations. In some cases the m-services and applications are accessed through the Internet while in others, it is through SMS. As such, there are various categories of m-health services and apps ranging from data collection, disease surveillance, treatment adherence reminders, emergency medical response systems, support to health care professionals, rural health workers, supply chain management, health financing, disease prevention and health promotion[30].

Box 5: m-Cessation (m-Health for Smoking Cessation)

The project, launched in Costa Rica in April 2013, aims to prevent smoking-related diseases such as cancer and other lung diseases. Tobacco smoking has been recognized as a big problem in Costa Rica and many health costs are considered preventable by getting people to quit smoking.

The project includes building and maintaining a database of mobile numbers based on a registration process, creating tailor-made short messages and developing two-way communication with smokers. This will entail managing both outgoing and incoming short messages.

A mechanism for feedback and reporting management has been established at the Ministry of Health.

Source: M-Powering Development Initiative

The need to continually review universal access policies and mechanisms is necessary in order to inform the establishment of a universal service framework that will enable governments to achieve their public policy objectives of availability, affordability and accessibility of services in a fast converging sector. Strategies to embed diverse innovative mechanisms such as public private partnerships and multi stakeholder projects in the design of universal access policies will be crucial for them to remain agile and responsive to the ever changing demands[31].

4.1.3 Pressure for resources

Spectrum

All wireless communications require radio spectrum. New entrants have made their way into the sector by leveraging on capabilities of disruptive technology, new spectrum access methods and new business models[32]. As a result, there is a proliferation of numerous m-services and applications which continue to build up pressure to free up access to more

[30] M-Powering Development Initiative Report 2015 at page 5. Available at: http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Documents/m-PoweringDevelopmentInitiative_Report2015.pdf (Accessed on May 28, 2015)

[31] See key elements to consider in development of an effective framework to address universality in GSR 2009 Background Paper, Trends in Universal Access and Service Policies by Sofie Maddens. Available at : http://www.ictregulationtoolkit.org/en/toolkit/docs/Document/3829 (Accessed on May 20, 2015)

[32] The Aspen Institute, Communications and Society Program, *"Spectrum as a Resource for Enabling Innovation Policy"* Feb, 2013 at viii Foreword

spectrum for broadband wireless network access. Regulators are scrambling to find more spectrum for the wider channels and greater throughput available with advanced wireless technologies such as LTE. Both licensed and unlicensed spectrum are needed to support the digital ecosystem, for connections appropriate to long and short distances, indoor and outdoor scenarios as well as mobile and static situations[33].

How is a regulator to respond to this pressure?

At this point the primary regulatory objectives will be three fold - to ensure availability of adequate spectrum to accommodate the increasing number of apps and m-services being delivered over mobile or WiFi networks, to ensure availability of the resources optimally in order to avoid erecting barriers on pricing or even competition and thirdly, and most importantly, to ensure that the existing spectrum policies can help create an environment that makes it easier for innovators to use spectrum as a resource for new technological goods and services[34].

Balancing needs – Incumbent vs New entrant

Innovators continue to encounter dilemmas presented by legacy systems on the road to innovation. One such dilemma is the legacy method of spectrum allocation that caters for exclusive use and high cost of access. This entry and growth barrier is often seen as a block to innovation by new entrants within a fluid and fast changing environment. Existing players tend not to be interested in disruptive ideas especially if there is a threat to their revenues and profitability. It is therefore incumbent upon the policy makers to adopt transformative approaches to guide future spectrum policy development and encourage incremental innovation[35]. A critical consideration will be to avail a transparent, market-based mechanism for spectrum access and eliminate any service and technology restrictions that may have been imposed within existing spectrum licenses in the past – as these may not be valid within a converged environment and may restrict the emergence innovative ways that the spectrum can be put to use.

In an effort to find solutions to share existing spectrum, it is prudent to consider new approaches to spectrum licensing (or utilization within an exempt framework) that are flexible. As a result, some old certainties and assignment methods that were based on clear lines between licensed and license- exempt frameworks are beginning to blur – with potentially uncertain results.

---

[33] GSMA, Mobile Policy Handbook, October 2014 at page 9

[34] Ibid. at v Foreword

[35] See sample proposals from The Aspen Institute, Communications and Society Program, *"Spectrum as a Resource for Enabling Innovation Policy"* Feb, 2013 (Available at: http://csreports.aspeninstitute.org/documents/Spectrum-Resource-Enabling-Innovation-Policy.pdf) (Accessed on May 4, 2015)

Perhaps more can be done at a spectrum policy level to provide a wider range of spectrum products[36]. One such idea is to enable a 'staircase' access to spectrum which is able to match spectrum access method with needs and funding constraints. This may in turn introduce spectrum access methods that allow low- to no-cost access to spectrum, reduce barriers to entry through entry of more flexible methods of allocating, clearing, using and/or sharing spectrum[37]. Additionally, database and sensing technologies are also driving opportunistic sharing, challenging current licensing conventions[38].

The momentum around Dynamic Spectrum Access (DSA) technology continues to gather, and in most cases, it is initially targeted at the white spaces in TV spectrum. DSA is an efficient and optimized technique of using under-utilized frequency bands, by improving the way wireless devices access spectrum resources. In TV broadcast channels, for example, under-utilized spectrum resource--known as TV white spaces--can be used to extend bandwidth capacity for wireless devices[39]. Singapore, was one of the very early adopters of DSA technology in its search for more bandwidth to meet the need for more connectivity.

There are several on-going commercial trials and pilots world-wide – in the UK, Philippines, Ghana, Kenya, Botswana, Namibia etc. In Africa, Microsoft has exclusively focused on demonstrating the technical feasibility of using TV white space technology to extend affordable Internet in underserved areas, using solar power in off-grid areas[40]. Perspectives are not fully settled on adoption of new spectrum access methods such as DSA as while they have been deployed commercially in some countries, others have adopted a cautionary approach. Going forward, regulators will engage in a cost benefit analysis between using innovative means for spectrum access to bridge the digital divide and obtain national coverage against the implications of adopting fixed or variable (dynamic) power level approach when it comes to TV White Space regulation.

---

[36] Ibid

[37] One such proposal from the United States President's Council of Advisors on Science and Technology (PCAST)—published in mid-2012— PCAST recommendations was the adjustment of policy initiatives including maintaining the clearance and auctioning approach, to enable a "staircase" access to spectrum. This would allow start-ups with limited resources to initially test their ideas using an experimental license. They can then transition to early commercial service using free unlicensed access, perhaps in TV white space. Next, as business grows, they can move to shared licensed access to federal spectrum for a moderate fee. Finally, as the full potential of the business becomes clear, they can acquire spectrum at auction in a conventional manner.
The range of proposals is available at:
President's Council of Advisors on Science and Technology, "Realizing the full potential of government-held spectrum to spur economic growth," July 2012. Available at:
http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf. (Accessed on May 16, 2015)

[38] GSR 14 Discussion Paper: New frontiers in spectrum licensing, Alden et al. Available at: http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2014/Discussion%20papers%20and%20presentations%20-%20GSR14/Session4_GSR14-DiscussionPaper-SpectrumLicensing.pdf (Accessed on May 29, 2015)

[40] Microsoft Research: Pilots & Demonstrations. Available at: http://research.microsoft.com/en-us/projects/spectrum/pilots.aspx (Accessed on June 1, 2015)

Numbering and addressing resources

One of the hallmarks of the digital golden age of mobile is connected living through the use of apps. Every device connected to the Internet requires a unique 'IP address' used to route data packets globally across the net. The current addressing system, called IP version 4 or 'IPv4', was deployed on 1 January 1983 and uses 32 digital bits to represent addresses, generating a theoretical total limit of 4.3 billion addresses. Given the significant growth of connections, numbering ranges will soon be in short supply[41] calling for the transition to IPv6[42].

There is need for regulators to anticipate the requirement of huge quantities of numbering and addressing resources with the advent of the digital age, and provide the resources in advance.

4.1.4 Protecting the Consumer

The eruption of mobile services and apps has created tremendous choice for consumers, who can now use services from a variety of providers. These changes have come in the wake of disruption of old regulatory constructs and created a complex landscape for the consumer to manouvre through.

It is a primary role for the regulator to create consumer awareness. It is also critical for the regulator to act as a custodian for the consumer and set the scene for compliance with regulatory standards such as quality of service.

Quality of service

Consumers are also continually seeking enhanced user experiences online. High broadband upload rates facilitate a collaborative online environment by encouraging user contribution, while high download rates enhance the accessibility of content. High bit transfer rates enable interactive functions such as real time feedback and video calling. Some services such as telemedicine and e-learning, require access at up to 100 Mbps, while standard applications such as email and web browsing can function speeds as low as 0.5 Mbps.

Evolving consumer needs demand higher speeds and reliable quality of service in order to ensure the secure transmission of sensitive data, such as for m–banking and m-health services across networks and across borders. The step up of consumer needs is prompting the re-definition of public policy goals for universal service from basic voice to include

[41] IPv4 and IPv6Issues, World Telecommunications Policy Forum (May 2013) Available at: http://www.itu.int/en/wtpf-13/Documents/backgrounder-wtpf-13-ipv4-ipv6-en.pdf (Accessed on May 29, 2015)

[42] A detialled discussion on the Need for more IP addresses can be found at : http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR_paper_theNeedforMoreIP%20Addresses_fin.pdf

Internet access[43] or broadband[44][45]. The quality of service on a wireless connection will depend on the use of others on the same access network and the backhaul capacity from the relevant base station to the core network. The need to uphold the quality of service is critical in order to foster diffusion, achieve seamless connectivity and optimal traffic management.

Compliance and Enforcement

The success of regulatory initiatives depends entirely on achievement of compliance thresholds on the various parameters – quality of service, type approval, licensing, network rollout obligations, competition, consumer protection etc. The planning, compliance, monitoring and enforcement functions therefore constitute critical success drivers within the digital ecosystem. These regulatory functions are reliant on periodic returns made by service providers as part of their license conditions.

Promoting choice

The ability of a consumer to be able to choose between one service provider over another for reason of better price, quality, etc. and be able to transition effectively is a hallmark of consumer enablement. Earlier efforts towards consumer protection tended to focus on provision of adequate information on service description, price and complaint mechanisms to the consumer. The digital ecosystem presents new opportunities and alongside them significant threats.

There are concerns on asymmetry of information between those who hold data and those who unintentionally or inadvertently supply it. It is therefore imperative for a consumer to be well aware of the impact of their engagement on the digital terrain to enable them on privacy and data protection concerns arising from the treatment and management of consumer information. Consumers are key stakeholders who are keen on obtaining value, are open to the benefits of innovation and are very useful in upholding performance within the digital ecosystem if they are aware of their rights and obligations as well as those of other pertinent parties.

Regulators have at their disposal certain mechanisms which they can put into place in order to promote consumer choice and competition. Implementation would in some cases involve re-examination of arrangements that had existed with the knowledge of the regulator previously but are found to be no longer tenable and others would involve adoption of new mechanisms to foster m-services and apps. This section discusses some of these mechanisms.

---

[43] Kenya: The Kenya information and Communications (Universal Access and Service) Regulations, 2010. Accessed at: http://www.ca.go.ke/images//downloads/sector_regulations/(Universal%20Access%20and%20Services)%20Regulations,%202010.pdf on May 16, 2015

[44] Nigeria: http://www.ijeit.com/vol%202/Issue%2012/IJEIT1412201306_22.pdf (Accessed on May 16, 2015)
International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 12, June 2013 117
Sustaining Broadband Infrastructure Expansion through Universal Service Provision Fund (USPF) E. C. Arihilam, Okorie.Emeka, Nwakanma Mary N. at page 118

[45] India: http://www.usof.gov.in/usof-cms/usof_roadmap.htm (Accessed on April 4, 2015)

Dealing with lock-in arrangements

Today, a regulator will need to respond to situations where some service providers institutionalize lock-in mechanisms through imposition of long-term contracts with their customers and obligations to pay termination fees upon discontinuation. Other scenarios occur in the context of consumers being locked-in for the use of a particular m-service linked to a provider of m-services that may offer the service only to its customers (See Safaricom and M-Pesa situation discussed earlier). This makes it difficult for consumers to move their data and information from one provider to another.

Such unconscionable practices raise consumer protection and competition concerns as while it is important to ensure that consumers make informed decisions prior to signing up with a service provider, it is equally important for consumers to be able to switch from one provider to another. In responding to such concerns, in 2009, the EU Universal Service Directive was amended require EU Member States to ensure that customer contracts cannot exceed 24 months and that operators also offer contracts with a maximum duration of 12 months[46].

Number portability

Mobile telephony has re-defined 'connectedness' to an extent that calling a person is really calling a number because people and businesses become closely associated with their phone numbers. It therefore is a huge consumer and competition consideration for mechanisms for number portability to be provided and facilitated in order not to undermine consumer choice. Porting is a regulatory arrangement that would promote consumer choice and enable the consumer to move their number together with any m-services and apps that are tagged onto that number.

Standards and interoperability

From traditional mobile voice services to m-health, m-education, m-agriculture, m-payments, m-investment, m-donations it is clear that we are now in the eras of m-of-everything! The ability for devices to connect to one another and 'speak' to one another continues to herald numerous possibilities[47].

The proliferation of platforms, applications and services that cater to specific devices has the power to create isolated islands of devices in the absence of interoperability across these islands within the digital ecosystem[48]. There is a critical need to lift barriers that have traditionally been imposed for proprietary reasons to lock in commercial gain. Further,

---

[46] EU, "DIRECTIVE 2009/136/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services, Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector and Regulation (EC) No 2006/2004 on cooperation between national authorities responsible for the enforcement of consumer protection laws," 2009, http://eurlex. europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0136&from=EN.

[47] Your Building Has Data. What Is It Telling You? Available at: http://insights.wired.com/profiles/blogs/your-building-has-data-what-is-it-telling-you#axzz3arCbnctM (Accessed on May 22, 2015)

[48] Nakazawa & Edwards, A Bridging Framework for Universal Interoperability in Pervasive Systems at page 1. Available at: http://www.cc.gatech.edu/~keith/pubs/icdcs06-bridging.pdf (Accessed on May 22, 2015)

adoption of common standards and interoperability would set the stage for scaling and monetization of m-services and apps allowing for cheaper access, appropriation of benefits by broader segments of population and achievement of development goals.

Since the mobile standard is but one within the digital ecosystem, what is the role of the regulator in maintaining an open and level playing field through standards?

One of the critical pillars in driving a digital agenda is improved standard-setting procedures and increased interoperability. Legacy type approval regulatory processes need to be reviewed in order to assure an expanded space for mutual recognition through type acceptance. European public authorities are particularly active in promoting interoperability[49]. In commitment to this critical success factor, the digital agenda for Europe requires that all new IT devices, applications, data repositories and services interact seamlessly anywhere – just like the Internet[50].

Box 6: Pillar II: Interoperability & Standards[51]

The Internet is a great example of interoperability – numerous devices and applications working together anywhere in the world. Europe must ensure that new IT devices, applications, data repositories and services interact seamlessly anywhere – just like the Internet. The Digital Agenda identifies improved standard-setting procedures and increased interoperability as the keys to success.

Many governments and regulators promote interoperability and open systems by enforcing anti-trust regulations and adopting open source software and open standards in their own digital activities[52]. French legislation, for example, mandates that when digital content is protected by proprietary digital rights management technologies, providers must give other software and hardware developers access to the necessary technical documentation to make their systems interoperable with it. Apple's iTunes is under scrutiny both in France and elsewhere in the EU[53].

---

[49] World Economic Forum, Digital Ecosystem Convergence between IT, Telecoms, Media and Entertainment: Scenarios to 2015 http://www3.weforum.org/docs/WEF_DigitalEcosystem_Scenario2015_ExecutiveSummary_2010.pdf at page 5 (Accessed on May 22, 2015)

[50] Digital Agenda for Europe. Available at: http://ec.europa.eu/digital-agenda/en/our-goals/pillar-ii-interoperability-standards (Accessed on May 22, 2015)

[51] Digital Agenda in the Europe 2020 Strategy. Available at: http://ec.europa.eu/digital-agenda/en/our-goals (Accessed on May 22, 2015)

[52] World Economic Forum, Digital Ecosystem Convergence between IT, Telecoms, Media and Entertainment: Scenarios to 2015 http://www3.weforum.org/docs/WEF_DigitalEcosystem_Scenario2015_ExecutiveSummary_2010.pdf at page 5 (Accessed on May 22, 2015)

[53] Ibid.

The recommendation to foster interoperability is often controversial as it proposes a sense of co-operation among competitors[54]. It suggests trade-offs that must be faced when trying to achieve cross-platform interoperability within a bridging framework for universal interoperability[55]. This proposition has often received equivocal support, leading to uncertainty about the strength of governments' commitment to fostering competitiveness in the digital ecosystem with the aim of growing the "knowledge economy. [56]" Gains however continue to be made over time.

In June 2014, Tanzania MNOs became the first in Africa to enter into an interoperable mobile money pact[57]. This was achieved following months of negotiation and regulatory facilitation to adopt exchange 'interconnection' agreements akin to those typically used for voice calls and text messaging. This agreement will enable customers to send and receive money across networks and the e-money will go directly to the respective subscriber's e-wallet account.

4.1.5 Infrastructure sharing

The reach of an MNO network has in the past played greatly to determine profitability and even dominance within a market. Due to this efforts to encourage infrastructure sharing are often resisted by incumbent operators in an effort to retain a competitive advantage over newer entrants. This structural infrastructure arrangement would then mean that some m-services and apps can only be accessed by a consumer depending on the reach of their network.

One of the innovative regulatory approaches to address this would be to mandate infrastructure sharing so as to broaden the geographical reach of MNO networks and in this way enlarge the platform on which m-services and apps can ride on. This innovative approach would resonate particularly in the developing world as it would enable development into remote and uneconomical areas faster. It would also enable the

---

[54] See contestation in Kenya between MNOs : Airtel had petitioned the Competition Authority of Kenya () to compel Safaricom, Kenya's biggest telco to open up its M-Pesa agency network. Available at: http://www.businessdailyafrica.com/Corporate-News/Safaricom-wins-M-Pesa-charges-case/-/539550/2396726/-/v7sxibz/-/index.html (Accessed on May 22, 2015)

[55] Nakazawa & Edwards, A Bridging Framework for Universal Interoperability in Pervasive Systems at page 1. Available at: http://www.cc.gatech.edu/~keith/pubs/icdcs06-bridging.pdf (Accessed on May 22, 2015)

[56] World Economic Forum, Digital Ecosystem Convergence between IT, Telecoms, Media and Entertainment: Scenarios to 2015 http://www3.weforum.org/docs/WEF_DigitalEcosystem_Scenario2015_ExecutiveSummary_2010.pdf at page 5 (Accessed on May 22, 2015)

[57] http://www.theeastafrican.co.ke/business/Tanzania-telcos-in-Africa-first-interoperable-mobile-money-pact/-/2560/2337358/-/137voj6/-/index.html (Accessed on May 22, 2015)

implementation of national broadband plans and network upgrades. In this way ICT infrastructure would be optimized as a 'utility' by all sectors in the provision of m-services and apps in sectors such as education, health, sport, transport and agricultural support[58].

4.1.6 Trust and confidence

A lack of trust and confidence can act as a major barrier to growth in a data driven economy. Regulators should influence a step up in consumer protection by encouraging MNOs to enhance security of their networks through adoption of encryption technologies. This is a critical requirement to ensure that sensitive data being transferred over the network, relating to, m-payments, for example, is transmitted securely and seamlessly.[59]

Robust security measures are therefore critical for the whole value chain including device and chip manufacturers as well as software vendors. Reducing vulnerabilities in devices, applications and web services should be a priority for all parties within the digital ecosystem[60].The centrality of trust and confidence to assure security, privacy and data management in the use of ICTs generally is recognized as one of the main pillars of the information society[61].

More and more, regulators have been called upon to respond to numerous public security concerns – 'mobile menaces' where kidnapping, terrorism, drug trafficking and money laundering are committed through the agency of the mobile phone. This calls for regulatory action that will preserve the integrity of mobile services to prevent the loss of trust. In Kenya, this situation was dealt with through mandating MNOs through legislation to capture details of persons subscribing to telecommunications services in order to preserve trust and security of subscribers of telecommunication services[62].

In view of this, development of comprehensive privacy and data protection legislation at the domestic level would boost data safety in the digital ecosystem and regulators should play a key role in shaping this going forward. The security and privacy of peoples' personal information however remains a challenge due to a patchwork of geographically bound privacy regulations.

4.1.7 Regulating in a multi-sectoral environment

It is evident, so far, that going forward, the ICT sector regulator cannot claim total scrutiny and authority in an environment that is fast converging and integrating to create a new landscape.

---

[58] M-Powering Development Initiative Report 2015 at page xi. Available at: http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Documents/m-PoweringDevelopmentInitiative_Report2015.pdf (Accessed on May 28, 2015)

[59] GSMA Mobile Policy handbook, October 2014 at page 182

[60] GSMA, Mobile Policy Handbook, October 2014 at page 9

[61] World Summit on the Information Society, Geneva Action Plan , Action Line C5 http://www.itu.int/wsis/docs/geneva/official/poa.html (Accessed on May 12, 2015)

[62] Kenya Information and Communications (Registration of SIM-Cards) Regulations, 2015.

http://www.ca.go.ke/images//downloads/sector_regulations/(Registration%20of%20subscribers%20of%20Telecommunication%20services%20regulations)%20Regulations,%202012.pdf. These regulations are currently under review.

The reality is that multiple agencies will be called upon to address a mutual issue under consideration and to offer their expertise and give greater visibility and commitment to digital inclusion. The sector regulator will need to reach out to other regulators in collaboration and partnership.

This is the new normal.

Emergence of stakeholder diversity

The m-service and app ecosystem works on different business models and is capable of attracting any number of users. Due to this, regulators should be careful to conduct stakeholder identification on a case by case basis. In addition to the conventional telcom sector regulators, the cross sectoral effect will bring in a broad array of influencers – ranging from midwives and teachers in rural areas (for m-health and m-education services and apps) to city residents (for m-transport and smart metering services and apps). The content and context of each m-service and app will attract a unique range of stakeholders who have a stake in and would wish to influence the outcomes.

Stakeholder engagement assumes a new prominence within a cross sectoral environment. The ICT regulator would need to engage awareness creation across sectors in order to spark interest in commercial deployment of m-services and apps as a means of service and information delivery. It will be necessary for regulators to engage more resources to undertake the role of identification and engagement of stakeholders as an act of support for diffusion of m-services and apps. Now more than ever before, the regulator will be requires to consult within a multi-stakeholder framework for feedback, communicate effectively and to aspire to articulate the wishes and aspirations of the stakeholders in order to foster diffusion of m-services and apps.

Below is an illustration of the broad range of stakeholders involved in the development and use of an m-Health service.

Box 7: Bhutan Epilepsy Project

In the deep, remote valleys of the Kingdom of Bhutan, a small country in South Asia bordered by China to the north, a boy slips on a plastic headset that looks like a shower cap. This is how the boy will be diagnosed with epilepsy using fast-growing mobile health technology to bring improved medical care to underserved parts of the world. The readings will be taken through the headset on a new application on a cellphone.

Just how underserved is Bhutan?

It does not have a single neurologist, nor does it have any technology to diagnose epilepsy, one of the most common neurological disorders and one easily treated with medication. For a population of 730,000 Bhutan faces a high burden of epilepsy (estimated at 1 out of 1,000 people). Most Bhutanese live in rural, mountainous villages which prevents them from receiving trained help for seizure disorders.

What are the telecom statistics in Bhutan like?

Despite living in rural areas, the Bhutanese are extremely well connected — more than 90 percent own a cellphone — making the country an ideal setting for this project. The Bhutan Epilepsy project is analyzing the mobile electroencephalography, or EEG, versus the stationary EEG technology, which is the standard epilepsy diagnostic tool in American hospitals.

The long-term goal of the project is to train the Bhutanese research coordinators to become more skilled at EEG so they can provide that service, and to communicate with hospitals and health facilities in other places through the use of simple text and personalized messaging.

Source: The Boston Globe, May 22, 2015[63]

[63] Available at: http://www.bostonglobe.com/business/2015/05/21/mobile-health-technology-helps-tackle-epilepsy-bhutan/c6vmO7XOznyDegIa4BYSAM/story.html (Accessed on June 3, 2015)

Stakeholders identified	
Government Mobile Network Operators Hardware and software vendors M-Health project team Project funders Health care professionals and associations -Medical doctors -Psychiatrists -Neurologists - Nurses -Community workers / educators etc. Data Readers Programmers NGOs Child rights activists Source: M-Powering Development Initiative Report 2015 at page 4[64].	Patients Parents / Guardians (for minors and patients who lack capacity) Regulatory authorities -ICT Ministries / regulators -Healthcare Ministries / regulators Ministries handling social services UN Specialized bodies -ITU -WHO -UNICEF -UNESCO Application developers Developers of healthcare related content Media Others

Emerging trends point towards more cross sector collaboration and partnership in order to handle the multiple issues to be reconciled. It is also clear that for the digital ecosystem to thrive, all key stakeholders must pull together in order to reap the benefits in a fast evolving sector. The continuous identification, mapping and engagement of stakeholders assume prominence due to the characteristically short time frames within which to make gains and the cross-sectoral scanning for stakeholders.

Due to the disruptive nature of the digital economy, the sector regulator will often be presented with issues, while pertinent, are not in its area of expertise. The development of m-Banking, m-Agriculture, m-Health etc. means that the intimate interface between the ICT sector and another specialized sector would lead to a situation of dual jurisdiction on some issues.

Collaboration across sectors

Regulators have adopted many approaches to handle issues of shared jurisdiction. Often, these scenarios arise from innovative initiatives, and may therefore not be anticipated and formally articulated. For example, there was no formal platform for collaboration between the CBK and the CCK during the M-pesa deliberations in Kenya. The absence of a formal arrangement to collaborate should deter best efforts particularly when the parties concerned recognize an idea whose time has come. Subsequently, steps were taken to formalize the collaboration.

[64] Available at: http://www.itu.int/en/ITU-D/Initiatives/m-Powering/Documents/m-PoweringDevelopmentInitiative_Report2015.pdf (Accessed on June 3, 2015)

In order to collaborate with a third party, a regulator must be clear about the powers it has under the law in order to determine the limits of collaboration. To design an effective collaboration both parties should be clear about the strengths – driven by their mandates - that they are bringing into the arrangement and determine the manner of conducting their collaboration. ICT regulators have pursued collaborations for mutual gain with competition authorities and financial regulator driven by the initial innovations across these sectors. A lot more collaboration with other sectors is contemplated as m-services and apps continue to permeate in all areas of life.

Going forward, regulators should commit to proactively seeking out mutual opportunities to collaborate, not driven merely by the need to facilitate an innovative idea, but more structurally to identify gaps or barriers to innovation and bridge them on order to foster growth of the digital ecosystem. The following areas are illustrative of areas that a regulator should focus on as a priority, to collaborate for sustainability and the achievement of development goals.

Collaboration to enable availability of big data

Big data continues to transform the way we live and work and alter the relationships between government, citizens, businesses, and consumers in future. It sets a platform for the public and private sectors to maximize the benefits of big data while minimizing its risks. Articulation of public policy that identifies opportunities for big data to grow our economy would promote the development of scalable, replicable and commercially sustainable mobile applications and services.

However it has not been possible to seize this opportunity in some countries due to policy gaps. For example, in some countries, the Meteorological Departments have blocked MNOs from using private weather information, referencing the government monopoly on this type of information. This kind of barrier hinders the uptake and value propositions of mobile agriculture solutions and would require intervention in order to drive data monetization of mobile agricultural information and advisory services[65]. Regulators could consider partnering to unlock opportunities with great development potential and leverage the widespread use and availability of mobile networks and services.

Collaboration to enable protection of Intellectual Property Rights

In the digital economy, copyright continues to perform the critical function of encouraging new works but also has a wider impact, playing a significant role in fostering innovation[66]. The impact of copyright is therefore now much wider than the creative industry alone. Digital

[65] GSMA Mobile Policy Handbook at page 36

[66] GSR 2011 Discussion Paper : "Intellectual property rights in today's digital economy" by Adam Denton (Available at: https://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/documents/05-Intellectual-property-E.pdf)

technologies, the companies that exploit them and the business models they facilitate are all potentially impacted by copyright.

Endemic copyright infringement facilitated by broadband infrastructure has drawn the MNOs and Internet communities into the debate on intellectual property rights. The film, music, software, publishing and television industries are putting pressure on the communication regulators to play a more active role in addressing both commercial copyright infringement and infringement by consumers – while at the same time encouraging investment and service innovation within the digital economy[67]. The ICT sector regulator needs to ensure that there is a balanced, proportionate and robust mechanism for players in the digital economy to flourish so that the societal benefits can be realized.

IPR issues fall out of the mandate of the ICT regulator. Pursuing the institutionalization of partnerships with the IP regulator will be mutual in encouraging development of relevant digital content and fostering an open and competitive digital environment.

Collaboration for optimal taxation

MNOs are a significant contributor to national economies and do stimulate activities in the wider economy further boosting GDP. A range of taxes are levied on MNOs and consumers such as excise duties on mobile handsets, sales tax on airtime usage and revenue share levies on mobile operators. These taxes contribute to a high tax burden which can prevent high consumer take-up of mobile services, discourage consumer usage and hinder investment in networks and services.

According to the ITU, although the telecommunication/ICT sector tax revenues play an important role in supporting national public services, this role must be weighed against the potentially adverse effects that taxation can bring to the growth of the telecommunication/ICT sector, broadband penetration, and national economic growth[68]. In this regard, the European Commission High Level Expert Group on Taxation of the Digital Economy has examined the best ways of taxing the digital economy in the EU, weighing up both the benefits and risks of various approaches[69].

Adoption of an optimal taxation policy that balances government revenue, socio-economic development goals and international competitiveness would be imperative. The impact of both direct and indirect taxation on the ICT sector remains a continuing concern for governments, businesses and consumers alike. Due to the direct impact of affordability and access to mobile services, a key role should be played by the regulator on sector taxation matters to amplify the positive impacts that have arisen with adjustment of tax rates.

---

[67] GSR 2011 Discussion Paper : "Intellectual property rights in today's digital economy" by Adam Denton (Available at: https://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/documents/05-Intellectual-property-E.pdf)

[68] Taxing telecommunication / ICT services: An overview (2013) Available at: http://www.itu.int/en/ITU-D/Regulatory-Market/Documents/Taxation%20Study-final-en.pdf (Accessed on May 20, 2015)

[69] 2014 Report of the Commission Expert Group on Taxation of the Digital Economy. Available at: http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/good_governance_matters/digital/report_digital_economy.pdf (Accessed on May 9, 2015)

Box 8: Taxation: Fostering the digital ecosystem

In Kenya, the removal of 16% VAT on mobile phone handsets in June 2009 saw handset purchases increased by more than 200% and mobile penetration increase from 50% to 70%. From 2009 – 2012, the prices of airtime fell by 70% and usage of mobile services rose by— 113%. Through increased handset circulation, a higher share of consumers has received access to high-value mobile services: M-Banking, M-Agriculture, M-Health.

5. Emergence of rights-based regulatory approaches and statutory recognition

This paper encourages the adoption of light touch regulatory mechanisms to foster the diffusion of m-services and apps. It is however important to indicate that some countries have adopted statutory pathways – a more formal approach - to define obligations for diffusion and access to m-services and apps. As previously indicated, regulatory approaches cannot be addressed with uniformity as countries should have the freedom to address their own unique circumstances as they deem best. This aspect is important because in such situations, m-services and apps are fostered through mandatory requirements in response to unique national circumstances.

The trend towards rights-based regulatory approaches has been driven by the social inclusion theory. It has in recent time inspired legal challenges that have confirmed that Internet and broadband access is gaining recognition as a basic human right[70]. This is the view that all people must be able to access the Internet in order to exercise and enjoy their rights to freedom of expression and opinion and other fundamental human rights. This means that countries have a responsibility to ensure that Internet access is broadly available, and that countries may not unreasonably restrict an individual's access to the Internet[71] and therefore, to m-services and apps.

Internet access is recognized as a right by the laws of several countries among them – Costa Rica, France, Spain, Estonia, Finland and Greece. One of the benefits of this approach is that statutory recognition gives impetus to implementation of Internet or broadband access plans, hence accelerating access to m-services and apps. While these countries are the fore runners of this rights based approach, is it likely that other countries will follow suit? It remains to be seen.

Other countries have used statutory pathways to push for the adoption of specific m-services and apps to meet certain public policy goals. For example, in order to help mitigate the consequences of serious road accidents across the EU, the European Commission adopted two legislative proposals in June 2013 to ensure that by October 2015, cars will automatically call

[70] http://broadbandtoolkit.org/4.2

[71] http://muftinternet.com/policy/countries-with-right-to-internet-access-as-human-right/ (Accessed on May 18, 2015)

emergency services in case of a serious crash[72]. The "eCall" system automatically dials 112 - Europe's single emergency number - in the event of a serious accident[73]. The Commission proposed two pieces of legislation to help create and implement the system. The proposed legislation will focus on deployment of passenger vehicles through the type approval process[74].

Other recent examples such as ERA GLONASS[75] and SIMRAV[76] would indicate that there is a growing preference of legislative fiat over voluntary approaches to introduce services into the market. ERA GLONASS in Russia came about because of recent legislation that requires installation of monitors and in-vehicle sensors for such events as airbag deployment to automatically transmit location details and summon assistance via emergency cellular service. The motivation for is the reduction of the consequences of road accidents in Russia particularly in dangerous goods transport services.

Similarly, the Brazilian government introduced legislation to tackle the very high levels of vehicle crime through a program called SIMRAV. This will be achieved by the mandatory fitment of telematics systems through imposition of a requirement in legislation to all new vehicles in Brazil as a part of SIMRAV. Around 25 million vehicles are anticipated to be equipped by the end of 2015 and Stolen Vehicle Recovery subscribers could exceed 2.5 million by 2013.

The emerging scenario means that the very contemplation and articulation of public policy has to be pragmatic in keeping with the innovative character of the sector. M-services and apps possess a pervasive character that will continue to impact how we communicate, learn, socialize and conduct business. M-services and apps are relentless and will continue to move into our phones, device, homes and cities. It is perhaps in order to say that we are yet to experience the profound influence that they will wield on regulation of civic, commercial and social engagements in society.

The regulatory approaches used need to be flexible enough to respond to harmonization efforts across sectors and even geographical regions to address issues of data flow within the digital ecosystem. It calls for clear consideration to ensure that the regulatory approach adopted is not a barrier to future innovation and progress. If in doubt – do not prescribe or regulate as innovation needs time and freedom to blossom.

---

[72] http://europa.eu/rapid/press-release_IP-13-534_en.htm, Press Release issued in Brussels on June 13, 2013

[73] The eCall system communicates the vehicle's location to emergency services, even if the driver is unconscious or unable to make a phone call. It is estimated that it could save up to 2500 lives a year.

[74] GSMA Mobile Policy handbook, October 2014 at page 11.

[75] http://www.u-blox.com/en/ecall-era-glonass.html: (Accessed on May 16, 2015).

[76] http://www.gsma.com/connectedliving/wp-content/uploads/2012/05/m-Rodrigues-da-Luz-GSMA-LATAM-Summit-2012.pdf: (Accessed on May 16, 2015)

6. Setting new regulatory objectives

The emerging digital ecosystem is generating many risks and challenges for government policies, as well as presenting new opportunities for creating social and economic value. Just as any healthy ecosystem enables its stakeholders to interact to the benefit of all, a healthy digital ecosystem should simultaneously enable investors to create economic value and deliver well-being to society. It will however be necessary to set new regulatory objectives to address the critical uncertainties present in this ecosystem.

Establishing an environment that fosters creativity and innovation, enables competition, and promotes consumer choice and exploits the transformative potential of digital technology fully means finding a delicate balance that both stimulates and protects all the different stakeholders. Having recognized the phenomenal opportunity that diffusion of m-services and apps can yield, governments and regulators could consider seeking technical assistance from specialized agencies such as the ITU to better understand the digital landscape and evaluate their existing frameworks in order to align them with appropriate policy and regulatory frameworks to foster diffusion[77].

There is no simple response to articulate regulatory approaches that can be adopted to foster m-services and apps within the digital ecosystem. Indeed, countries have their own unique circumstances that call for different priorities. One running theme that is clear is that it is beyond the scope of the ICT regulators to resolve all of the challenges alone. It calls for a balanced approach in order to foster mutuality of purpose and foster regulation in a cross-sectoral environment. The disruptive nature of technologies has opened up a new platform in the digital ecosystem in which ICT regulators can, and should seize the moment to influence in order to promote m-services and apps.

The regulatory architecture of today should build a digital future we can be proud of. More than any other period in history, governments are suited to articulate public policy that will ensure that the digital ecosystem continues to work for individual empowerment and social good. The perspectives discussed in this paper have highlighted that a regulatory framework that is open, forward-looking, neutral and flexible to allow leveraging on new technologies, innovative services and new business practices ensures enhanced market competitiveness and maximization of economic opportunity.

With the changing environment, the old regulatory construct has been eroded and given way to new possibilities. Rules need to be re-written in some instances to accommodate the emerging realities. The paper recognizes that regulating in a fast changing sector is like aiming at a moving object – hence the need for a flexible, adaptable approach – to allow for changing

[77] See Bhutan Project Report on Emerging Mobile Applications Opportunity June 2012 Available at: http://www.itu.int/ITU-D/asp/CMS/Docs/Bhutan%20EV4.pdf (Accessed on June 2, 2015)

positions. Overall, it has emerged that 'light touch' nurturing of the digital economy is a safer regulatory option over strong intervention in most cases.

But an innovative and effective regulatory environment does not develop in isolation. It needs inspiration. It needs collaboration. It needs diverse opinions from multiple perspectives to challenge a good idea and transform it into a great one.

7. LIST OF ACRONYMS

App	Application
CA	Competition Authority
CAK	Competition Authority of Kenya
CBK	Central Bank of Kenya
CCK	Communications Commission of Kenya
DSA	Dynamic Spectrum Access
DRM	Digital Rights Management
EEG	Electroencephalography
EU	European Union
GDP	Gross Domestic Product
GNI	Gross National Income
GPS	Global Positioning System
GSMA	GSM Association
HIV/AIDS	Human immunodeficiency virus infection and acquired immune deficiency syndrome
ICT	Information and communication technology
IDA	Infocomm Development Authority of Singapore
IP	Internet Protocol
ITU	International Telecommunications Union
IPR	Intellectual Property Rights
IFI	International Financial Institution
KYC	Know your customer
LTE	Long Term Evolution
MDG	Millennium Development Goal
M-services	Mobile services
MNO	Mobile Network Operator
OECD	Organization for Economic Co-operation and Development
SDG	Sustainable Development Goals
SMS	Short Messaging Service
TV	Television
TVWS	Television White Spaces
UHF	Ultra High Frequency
UN	United Nations
UNFPA	United Nations Population Fund
VHF	Very High Frequency
WiFI	Wireless Local Area Network
WIPO	World Intellectual Property Organization
3G, 4G	Third generation, Fourth Generation