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Capitalizing on the potential of the digital world

Discussion Papers

GSR discussion paper

Consumer protection in the online world

Work in progress, for discussion purposes

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Consumer protection in the online world

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1 Introduction

This paper is for discussion by the GSR and is aimed at examining the changing usage patterns of consumers and what the local and globalised ICT consumers of digital services expect in terms of protection when they conduct various types of activities online.

The paper examines the need for revised regulatory frameworks and explores the various options available, such as co-regulation and self-regulation, based on country experiences from around the world. It discusses the need for greater collaboration and cooperation at the regional and international levels. This paper complements the study carried out in 2012 on consumer protection in a converged world[2].

The discussion paper starts by looking at consumer protection in the online world. It describes the needs and concerns of digital consumers when they engage in the most common forms of online activities: searching the internet, shopping online, making payments, consuming music and video, gaming and using apps, using social media and cloud services.

The paper identifies a number of cross-cutting regulatory issues that need to be addressed by policy makers, regulators[3] and industry to ensure that digital consumers are correctly protected when engaged in these online activities:

- privacy
- security
- fighting illegal and harmful content
- copyright
- net neutrality
- payments
- consumer rights and trust
- delivery
- consumer redress and education

It highlights some of the responses that have been given around the world and shows some recent attempts to address specifically the conduct of new market players such as search engines, cloud and app service providers.

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[1] Michèle Ledger, Javier Huerta Bravo, James Thomson

[2] http://www.itu.int/en/ITU-D/Regulatory-Market/Documents/Regulation%20and%20consumer%20protection.pdf

[3] In this report, the term 'regulator' means a regulatory authority or body, or a public authority or agency responsible for exercising some sort of authority over an activity or category of operator: a telecom NRA, a financial authority, a media regulatory authority, a competition authority, a privacy authority etc..

2 Setting the scene

2.1. Rapid growth

It is now clear that in many regions of the world, consumers have a strong online presence for many aspects of their lives (working, socialising, communicating, consuming...) and this trend is set to continue.

A recent OECD report[4] highlights that e-commerce has been growing steadily since it first emerged[5]. From 2004 to 2010, e-sales grew from 9 to 14% of the turnover of non financial enterprises in the European Union, and from 10% to 16% in the United States.

The OECD highlights that growth is uneven among countries and regions of the world and that:

B2B sales dominate in terms of value of transactions

E-commerce is dominated by business-to-business (B2B) sales, with around 90% of the value of e-commerce transactions coming from B2B.

B2C transactions growing faster than other segments

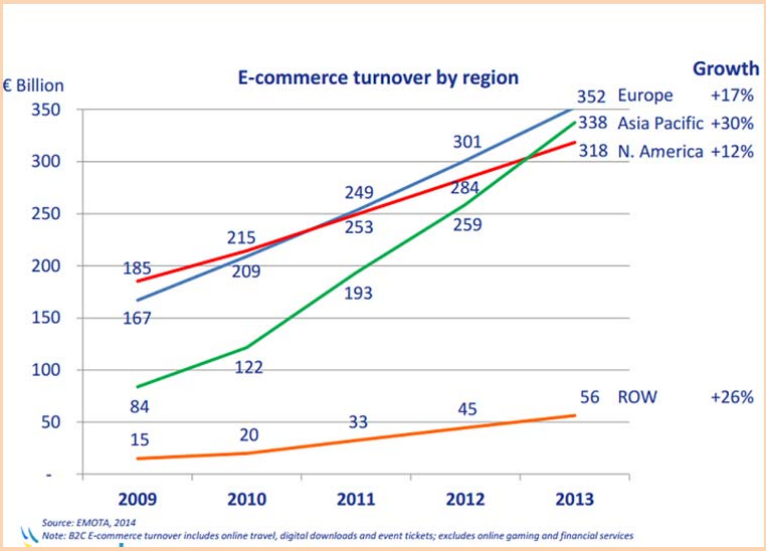
The remaining 10% of transactions are a combination of business-to-consumer (B2C), business-to-government (B2G) and consumer-to-consumer (C2C) activities. Recently, B2C transactions have been growing faster than other segments, but from a lower base.

Figures from Emota, the European Distance Selling Association, show that growth is fastest in the Asia Pacific region (wih a 30% increase between 2009 and 2013).

[4] OECD (2013), "Electronic and Mobile Commerce", OECD Digital Economy Papers, No. 228, OECD Publishing. http://dx.doi.org/10.1787/5k437p2gxw6g-en

[5] B2C E-commerce started in the mid-1990s with the birth of major companies: Amazon (1994) and eBay (1995)

Figure 1 - e-commerce turnover by region



Source: Emota, 2014

Ofcom, the communications regulator in the United Kingdom, has also published figures[6] which show that the United Kingdom spends the most per head on online shopping among a group of comparator countries (UK, France, Germany, Italy, USA, Japan, Australia and Spain).

Online spend per head in the United Kingdom was £1,175 ($1.974) in 2012. Australia was second highest with spend per head of £867 ($1.456), followed by the US £663 $1.113) and Japan £560 ($940,8).

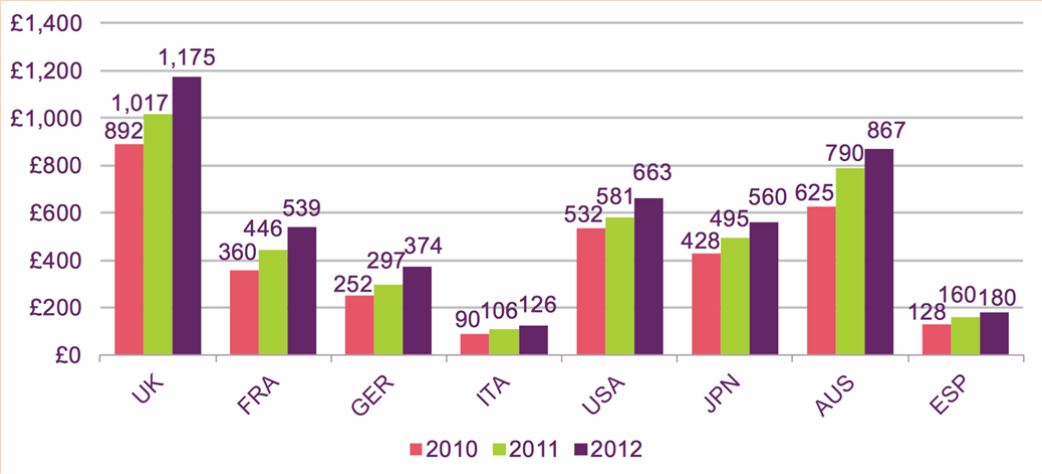
Online sales accounted for 10.5% of total retail sales in the UK in October 2013[7]; and 6.0% in the US in the fourth quarter of 2013[8].

6 http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr13/international/

7 http://www.ons.gov.uk/ons/rel/rsi/retail-sales/october-2013/sty-internet-sales.html

8 https://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf

Figure 2 - Online spend per head



Source: Ofcom (uk)

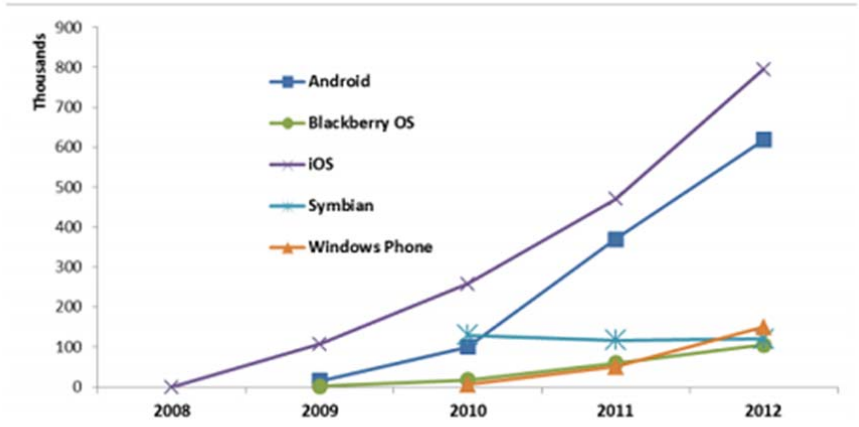
A clear trend is that increasingly, B2C e-commerce is taking place through smartphones, tablets and apps. The OECD[9] predicts that the widespread use of smartphones and mobile apps provides a powerful new platform for the growth of e-commerce, especially given the fact that technologies enabling payments (such as Near Field Communication, NRF) are increasingly being integrated into handsets.

This figure illustrates the growth of apps available for download between 2008 and 2012. The growth of apps changes the way that people access information, with increased access on smartphones and tablets, and with less access through web browsers[10].

[9] OECD (2013), "Electronic and Mobile Commerce", OECD Digital Economy Papers, No. 228, OECD Publishing. http://dx.doi.org/10.1787/5k437p2gxw6g-en

10 OECD (2013), "The App Economy", OECD Digital Economy Papers, No. 230, OECD Publishing. http://dx.doi.org/10.1787/5k3ttftlv95k-en

Figure 3 - Growth of apps available for download by platform, 2008 -2012



Source: Statista.com, 148apps.biz, appbrain.com, and company profiles (2013)

2.2 Gatekeepers and monopolies

As shown in the table below, some parts of the internet value chain are dominated by a very small number of players. This is particularly the case in online search and social media.

This means that for some of the activities described in the following section, digital consumers will have the choice between a very small number of providers.

Figure 4 - Worldwide market shares in 2012

	Vertical markets					Horizontal markets		
	Operating system (PC)	Operating system (Mobile)	Browser (PC)	Browser (Mobile)	Search	Social network	Internet portals	Online advertising
Google	-	37%	40%	43%	90%	<1%	-	32%
Microsoft	91%	1%	29%	3%	7%	<1%	12%	3%
Apple	7%	25%	8%	39%	-	<1%	-	-
Facebook	-	-	-	-	-	79%	-	4%
Yahoo	-	-	-	-	-	<1%	26%	3%

Source: Italian communications authority, AGCOM[11]

2.3 Advertising

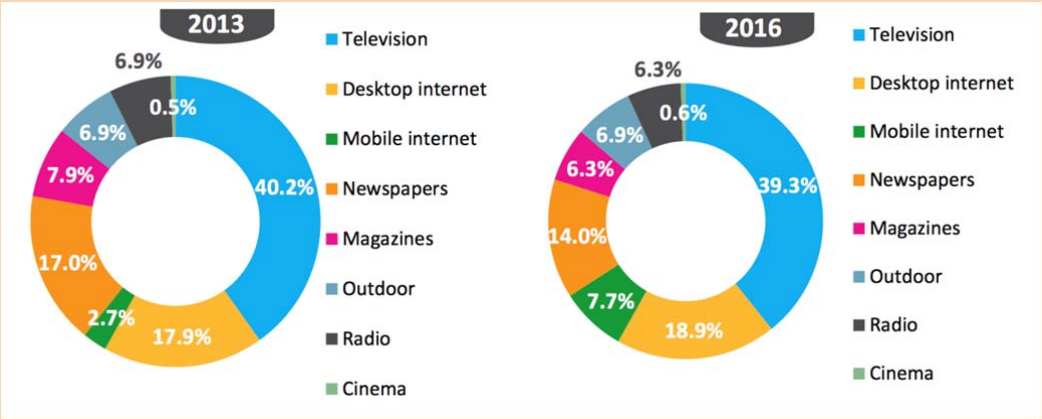
Many of the most popular internet services are free to use (e.g. search and social media) for digital consumers. Digital consumers may not be aware that a completely free service on the internet rarely exists, and that these apparently free services are in fact financed by advertising.

Internet is currently the second largest advertising medium after television globally.

Internet advertising is predicted to increase its share of the global advertising market from 20.6% in 2013 to 26.6% in 2016, according to ZenithOptimedia.[12]

Mobile internet advertising is growing much faster than desktop internet advertising, driven by the rapid adoption of smartphones and tablets.

Figure 5 -Share of global adspend by medium (%)



Source: ZenithOptimedia

[11] http://www.agcom.it/Default.aspx?message=visualizzadocument&DocID=12657

http://www.zenithoptimedia.com/wp-content/uploads/2013/12/Adspend-forecasts-December-2013-executive-summary.pdf

3 Main online activities

This section gives an overview of the main online activities of digital consumers in the digital world, illustrating their concerns and needs. Cross cutting regulatory issues (i.e. those which span a number of online activities) and attempts to regulate new activities and market players are addressed in more detail in the following sections.

3.1 Search

Consumers very often start by searching the Internet. As the chapter above mentioned, search is mainly done (90 %) through Google search. Users may have the following concerns when using search engines:

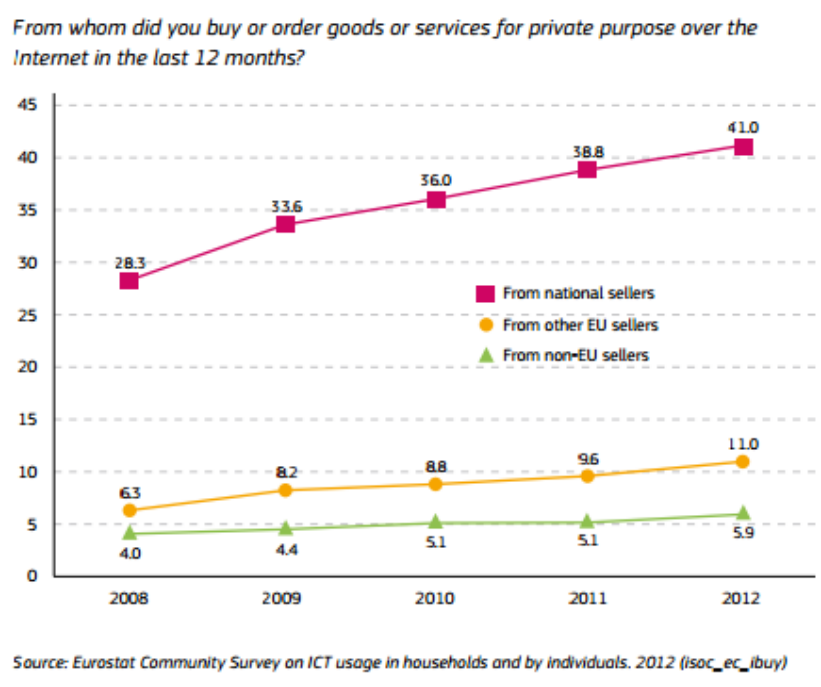
- how will their search data be used? Will it be sold for commercial purposes, or used for law enforcement?
- have the search results been manipulated in some way?
- will they be exposed to illegal or damaging search results? If so, what should they do?

Because of the scarcity of operators, digital consumers are concerned about the way they operate on the market and expect a high level of protection and transparency.

3.2 Shopping online

Consumers are increasingly buying goods online. According to figures for the EU, there is also a growing gap between domestic and cross-border e-commerce. Consumers are more inclined to buy from domestic websites than from websites that are located in another country.

Figure 6 - Percentage of the population who ordered goods or services over the Internet from national sellers/ from sellers from other EU countries/from sellers from the rest of the world (non-EU) in the last 12 months (EU 27)



The proportion of online cross-border shoppers has however grown in all countries since 2008 and according to a report by the European Commission[13], the largest increases are observed in Malta (21 percentage points), Luxembourg (17), Belgium (16) and Finland (15).

Consumers face particular issues when they shop from websites that are located in other countries

The particular concerns are as follows:

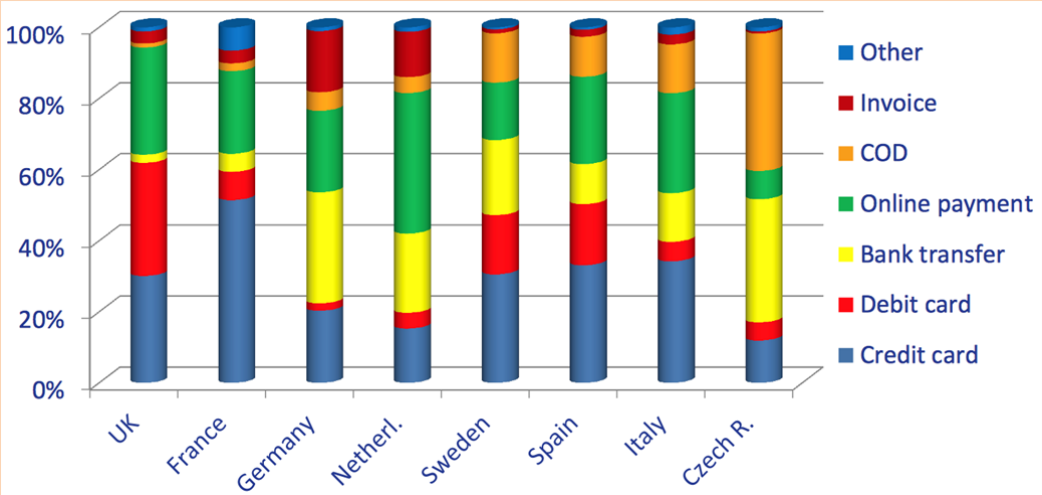
- Consumers do not know who is operating on online store or how to contact the website for more information, for instance on the ordering process.
- If things go wrong (e.g. the ordered goods do not arrive, or the customer is billed twice) consumers very often do not know where to go for redress.
- When making purchases online, consumers are usually asked to tick a box to confirm they accept the terms and conditions. The conditions are generally very long and consumers have no choice in accepting them if they want to make the purchase.
- Will they receive their ordered goods on time?

[13] The Consumer Conditions scoreboard – Consumers at home in the single market – sWd(2013) 291, http://ec.europa.eu/consumers/consumer_research/editions/docs/9th_edition_scoreboard_en.pdf

3.4 Making payments

The preferred payment methods for online purchases vary considerably among countries. In the UK, credit and debit cards and the PayPal online payments platform account for nearly all of the market. In other countries, bank transfer and payment by cash on delivery (COD) are also important payment methods.

Figure 7 - Online payment methods by country in 2011



Source: EMOTA[14]

New methods of payment are being developed, including mobile phone payments/m-wallets (payments through SMS, payments charged on consumer mobile operator's bills, etc). The growth in use of mobile devices to make payments is expected to accelerate, especially in developing countries where many consumers do not have bank accounts and do not have access to credit cards.

The digital consumer needs assurance that these new methods of payment will be sufficiently trustworthy.

When consumers get to the stage of paying for their online purchases, they often find that there is a surcharge for paying by credit or debit card rather than by other means such as the Paypal online payment platform. For example, surcharges are common for purchases of airline tickets.

Consumers may be worried about the risk of their bank or credit card details being stolen and used to make unauthorised transactions.

3.4 Music and video

Consumers may find that access from their country to websites offering legal streaming or download services for music, video or television is blocked or that the catalogue of content is restricted. Geo-blocking is done based on the IP address of the visitor.

[14] http://media.wix.com/ugd/b18286_390bb25f5c1340fbbc9df4945b56ad16.pdf

For example:

- The availability of Netflix outside of the US is restricted to the following countries: Canada, Mexico, throughout South America, United Kingdom, Ireland, Netherlands and Nordic countries[15].
- Across Europe, some of the live streaming and catch-up services of the main national commercial television channels and public service channels are either blocked or limited outside of their home country (e.g. the international (outside UK) version of BBC iPlayer gives access to a much narrower catalogue of content than the domestic version.

In many countries, there are only a limited number of legal services available and consumers tend to access music and video content through illegal services that are available on the Internet, either through P2P, download or streaming services. To by-pass geo-blocking, users are inclined to use proxy services which allow users to mask their home country location and to access the services that they could otherwise not access.

Video download and streaming services are very 'bandwidth hungry' and digital consumers will be want to be assured that their access to services is not blocked or slowed down by their broadband access provider – provided that the content is legal.

3.5 Gaming and using apps

Games marketed as “free to download” are not always free to play, as the players may need to pay for special content or features through in-app purchases.

Consumers need protection against unexpected costs from in-app purchases. Further, they may not be fully aware of the amount of money they are spending because their credit cards are charged by default.

Children are particularly vulnerable to marketing of free to download games.

3.6 Using social media

The use of social media entails many new types of concern, including in relation to the protection of minors.

The main problems are:

- Children are less aware than adults of the risks of sharing their personal information.
- Children seeing age-inappropriate content, such as sexual or violent content.
- Cyber bullying and exposure to negative user generated content (such as posts, comments, pictures or videos on social networks such as Facebook or online sharing platforms such as YouTube).
- Inappropriate contact from adults with a sexual interest in children.

In adulthood, problems can also arise, in particular with the protection of their personal data:

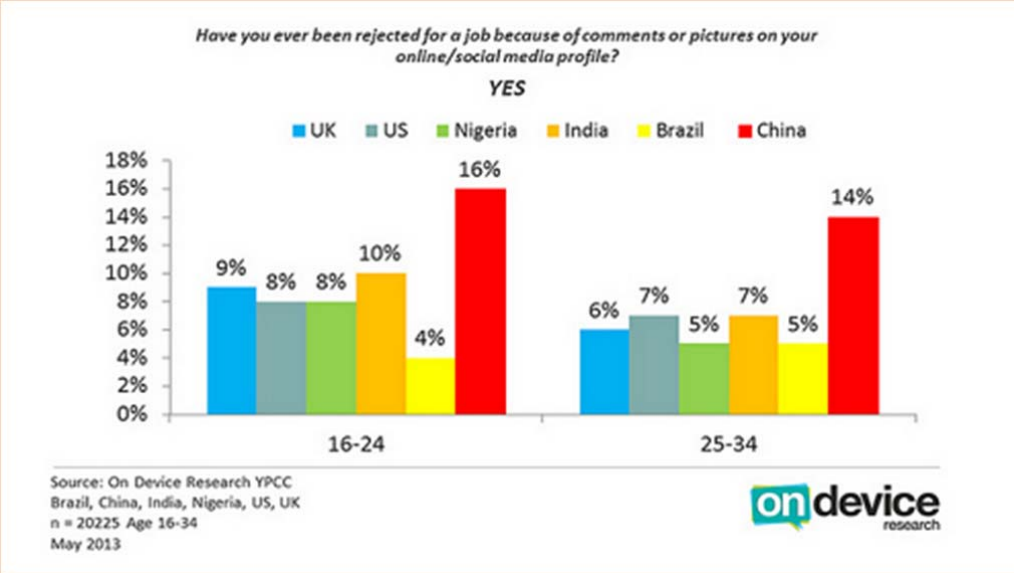
- Consumers are not always aware of the privacy issues that using social media involve.
- Consumers may face problems when they try to transfer their personal data from one social network to another. They are locked-in with a single operator.

[15] http://ir.netflix.com/faq.cfm

A recent study[16] has highlighted that one in ten young people have been rejected for a job because of comments or pictures on their social media profile. The report also reveals that a majority (two-thirds) are not concerned that their use of social media now, can harm their future career prospects and are not deterred from using it.

The report concludes that better education of the impact of social media is needed, to ensure young people are not making it even harder for them to get on the career ladder. This illustrates that it is important to enable digital consumers to erase their profiles from social media.

Figure 8 - Percentage of applicants that have been rejected for a job because of their social media/online profile



3.7 Using cloud services.

Demand for storage is increasing because of the sheer volume data that businesses and individuals are collecting, and the use of the cloud is now part of everyday life in developed countries[17]. It has numerous advantages in that users can store their files, software, photos, video, music etc. on the cloud and access their content when they need it on their smart phones, laptops or tablets from whatever location.

Consumers already use a range of cloud services, including web-based email (e.g. Gmail), social media (e.g. Facebook), software as a service (e.g. Office 365), and cloud storage (e.g. dropbox).

With cloud services, some of the particular concerns of digital consumers are as follows:

- Will the data (music, video, photos) be safe on the cloud?
- Will they be able to transfer the data from one cloud provider to another? (data portability)
- What will happen if the service becomes unavailable?

[16] http://ondeviceresearch.com/blog/facebook-costing-16-34s-jobs-in-tough-economic-climate#sthash.MLn5EZhF.Vp50W4rO.dpbs

[17] GSR 2012 Discussion Paper, The Cloud: Data Protection and Privacy Whose cloud is it Anyway?

- Is the cloud provider subject to any rules and regulations?

In the following section, we will attempt to answer some these questions.

4 Cross-cutting regulatory questions and the role of policy makers, regulators and market operators

4.1 Privacy

When accessing some of the online services referred to above, consumers may not feel in control of their privacy online. In particular, they may not know what personal information is being collected about them, who is collecting their personal data and who it is passed on to, what purpose(s) their data is being used for. In this context, consumers very often have no choice other than to accept the complex privacy terms or not to use the service at all.

The increasing monetisation of personal data has led some operators to massively collect individuals' personal data for different purposes such as behavioural advertising. In this regard, consumers sometimes do not understand that there is a trade-off between free to use services and the tracking and behavioural advertising that often finance those services. When accessing these services, consumers are often literally tracked without giving their consent, for the purpose of targeting personalised advertising to them. This issue has been put at the centre of the work programme of Consumers International[18].

Furthermore, consumers may face difficulties when they try to transfer their personal data from one operator (e.g. social network, cloud services provider) to another. Indeed, if they want to switch to another operator, they will in most cases have to re-enter all their personal data and information with the new operator. Given these difficulties, consumers may find too burdensome to shift to another operator. This situation also prevents new operators from accessing the market, thereby impeding effective competition.

Also, in some jurisdictions, competent authorities have enacted data retention laws obliging certain operators such as ISPs to retain for a period, certain types of personal data (in particular so-called traffic data, such as IP addresses, email addresses of senders and recipients) for law enforcement purposes. Consumers may not know that their personal data are retained or the conditions (e.g. duration, type of retained data, location of the retained data) under which the data retention takes place.

As reflected in the multistakeholder statement[19] following NETmundial, the Snowden revelations on mass surveillance activities by intelligence agencies have put data protection at the centre of the international debate on internet governance and have considerably increased consumers' awareness regarding privacy issues.

Regulatory landscape and trends

Privacy laws are being revised in some countries with the purpose of strengthening individuals' privacy rights.

In the EU, whose current data protection rules date from 1995,[20] a new proposal[21] includes a number of measures to reinforce online privacy rights. For instance, individuals' consent for the processing of personal data would have to be given explicitly (either by a statement or by a clear affirmative action), rather than assumed.

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18 http://www.consumersinternational.org/media/1113711/ci%20programme%20of%20work%20on%20privacy.pdf

19 http://netmundial.br/wp-content/uploads/2014/04/NETmundial-Multistakeholder-Document.pdf

20 http://ec.europa.eu/justice/newsroom/data-protection/news/120125_en.htm

21 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0011:FIN:EN:PDF

The new proposal also provides individuals with a right to data portability, whereby they would have the possibility to request from the operator a copy of their personal data or information[22] and to transmit them directly from one operator to another.

Also in the European Union, data retention laws are particularly vulnerable at the moment. They are being challenged before constitutional courts following the decision of the Court of Justice of the European Union to strike the data retention directive[23] as it did not respect EU citizens' fundamental right to the protection of their personal data[24].

Australia has recently adopted new data protection rules[25] that will strengthen consumers' rights by including measures aimed at improving consumers' access to companies' privacy policies, generally prohibiting the disclosure of individuals' data for the purpose of direct marketing, and establishing timely and effective complaints handling mechanisms.

In April 2014, Brazil, whose government is very much concerned about the issue of mass surveillance, adopted a new internet law, also known as 'Marco Civil'[26]. The law enshrines the right of internet users to privacy of their internet communications, and requires ISPs not to give third parties access to their registry of end users´ connections and applications, unless the end users have given their explicit consent, or in the cases foreseen by law.

Privacy rules vary considerably from one country to another and some countries completely lack privacy laws. The different levels of data protection throughout the world may bring some legal issues when consumers whose privacy rights have been violated seek redress in third countries, or when personal data are transferred from one jurisdiction to another. Indeed, cross-border personal data flows, which are an integral element of today's e-commerce, are continuously increasing, thereby elevating privacy risks. In this context, international cooperation is crucial. For instance, the EU and the US, whose respective privacy policy frameworks differ enormously, have developed a Safe Harbour Framework containing a number of privacy principles[27] to which US based companies may adhere. Under this voluntary scheme, Safe Harbour companies such as Google or Facebook can transfer EU citizens' personal data to the US. However, the Snowden revelations on alleged back-doors from US companies to the US intelligence agency have put this framework under scrutiny.

The global dimension of privacy issues has led some international organisations to take some initiatives regarding privacy. In 2013, the OECD adopted revised guidelines governing the protection of privacy and transborder flows of personal data[28]. The guidelines, which aim to harmonise OECD countries' privacy laws, include a number of principles such as purpose specification (i.e. the purposes of the data collection have to be specified), use limitation (i.e. data should not be disclosed or used for non-specified purposes

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[22] Some operators already offer to the users the possibility to obtain a copy of their data : seehttps://www.facebook.com/help/131112897028467 and https://support.google.com/takeout/answer/2508459?hl=en&ref_topic=2508503

[23] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:105:0054:0063:EN:PDF

[24] http://curia.europa.eu/juris/document/document.jsf?text=&docid=150642&pageIndex=0&doclang=EN&mode=req&dir=&occ=first&part=1&cid=406224

[25] http://www.oaic.gov.au/privacy/privacy-act/privacy-law-reform

[26] http://www.senado.gov.br/atividade/materia/getPDF.asp?t=147571&tp=1

[27] http://export.gov/safeharbor/eu/eg_main_018475.asp

[28] http://www.oecd.org/sti/ieconomy/2013-oecd-privacy-guidelines.pdf

without the individual's consent or when authorised by law), and security safeguards. Similar harmonisation intents have taken place in other international fora (e.g. APEC's privacy framework)[29].

Although these agreements and soft-law approaches may help in offering solutions to consumers' privacy concerns, more and more voices are advocating the adoption of a global instrument providing for strong privacy and data protection principles. In 2009, data protection authorities from different countries all around the world called for the establishment of a new international framework for privacy protection, with the participation of civil society[30].

Role of data protection authorities

Data protection authorities are increasing their efforts in protecting consumers' privacy rights by:

- conducting investigations and possibly fining major companies for not respecting privacy rules. For instance:
  - In May 2014, the Court of Justice of the European Union adopted a landmark decision obliging operators of search engines to remove from their search results links to other websites that contain personal data – at the request of the concerned individual and under certain conditions[31]. The Court ruling confirmed the decision of the Spanish data protection authority, who requested Google to remove the links directing to another website containing an individual's personal data. It implies that search engines are bound by the so-called right to be forgotten.
  - Several regulators from different countries around the globe (e.g. Macao China, United States, Republic of Korea, Germany) have fined Google for its collection of personal data without user's consent for the provision of its 'street view' services. According to the Korea Communications Commission, "the information collected included not only personal data such as online IDs, passwords and residential registration numbers but also around 600,000 Mac addresses that are highly likely to identify the user if used in combination with other information"[32].

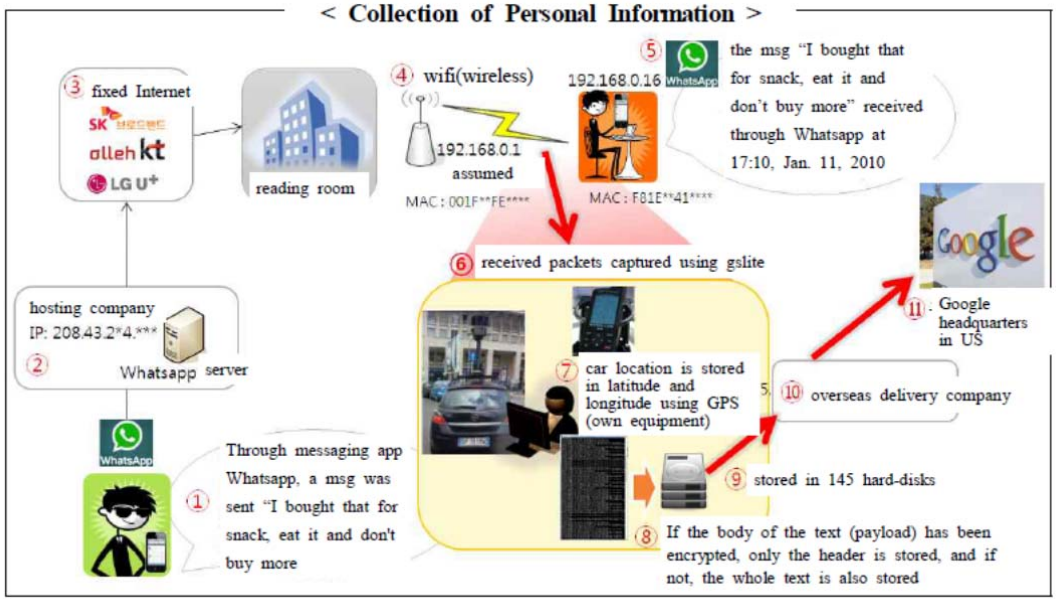
[29] http://publications.apec.org/publication-detail.php?pub_id=390

[30] http://privacyconference2012.org/wps/wcm/connect/2912ce004adc64f09e809ea0fea628d8/2009_M1.2.pdf?MOD=AJPERES

[31] http://curia.europa.eu/jcms/upload/docs/application/pdf/2014-05/cp140070en.pdf

[32] http://eng.kcc.go.kr/user.do?mode=view&page=E04010000&dc=E04010000&boardId=1058&cp=1&boardSeq=37564

Figure 9 – Google's collection of personal data for its "street view" services



Source: Korea Communications Commission

- issuing guidance in order to help different data controllers or processors in protecting consumers' personal data. Some examples:
  - The body representing European data protection authorities have recently issued recommendations on anonymisation techniques[33]. Anonymisation techniques are gaining importance in the context of Big Data. They consist in processing personal data to prevent the individuals' identification and allows operators to make information derived from the personal data they hold publicly available for different purposes (e.g. scientific research), whilst protecting consumers' personal data. As stated in the ITU-T Technology Watch Report[34], "some telecommunications operators have started exploiting aggregated customer data as a source of income by providing analytics on anonymised datasets to third parties". Anonymisation processes entail certain risks that personal data are disclosed and guidance can therefore be of utmost help for operators.
  - In 2014, representatives of the body representing European data protection authorities and of APEC economies agreed on a checklist aimed at facilitating personal data transfers for

[33] http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2014/wp216_en.pdf

[34] http://www.itu.int/dms_pub/itu-t/oth/23/01/T230100000220001PDFE.pdf

international businesses operating in both the EU and APEC economies, while respecting consumers' privacy rights[35].

Industry-driven initiatives

Conversely to regulation, standardisation and self-regulation can serve at exploring the economic or social benefits of personal data, whilst respecting consumers' privacy rights, as shown in the following examples.

Regarding behavioural advertising, although some countries' laws provide that tracking can only take place with the consumer's explicit consent, they do not go as far as to indicate the technical means by which consent can be given. In this context, standardisation initiatives can hugely help consumers. All of the major web browsers have a "do not track" (DNT) preference setting. The purpose of the DNT standard is to determine how a website or advertiser should reply to a notification expressed by an internet user (normally through a browser setting) that they do not wish to be tracked online. With this setting enabled, each time the browser fetches content from a website, it adds a request for the user not to be tracked – but it is up to the website and their third-party content providers (including advertisers) to honour this request. At present there is no agreed standard to implement DNT. The World Wide Web Consortium (W3C) has been working on a voluntary DNT standard since 2011, but reaching agreement between advertisers, website owners, browser producers, and consumer privacy advocates is proving challenging[36].

In the US, under the auspices of the Department of Commerce, different stakeholders have developed a code of conduct that brings transparency as regards the way providers of applications for mobile devices handle personal data[37]. It contains requirements for a short notice that would be presented to consumers after downloading an app. This notice should indicate what data the app collects, the means of accessing its privacy policy, and with whom it would intent to share the data[38].

Conclusions

The processing of personal data is an intrinsic part of consumers' day-to-day online activities. Most of consumers' online activities involve the processing of personal data (e.g. the mere access to a website, an online payment). Adequate protection of consumer's personal data is of key importance to the development of online activities.

Although some countries are strengthening their privacy laws, the coexistence of diverging legislative frameworks around the world does not help in building consumers' trust in cross-border e-commerce.

Industry initiatives are proving difficult to achieve as they require a high level of agreement among very different stakeholders. Regulators have a definite role to play to strengthen industry-led solutions such as anonymisation and privacy by design.

Recommendations

At the level of policymakers

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35 http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2014/wp212_en.pdf

36 http://www.w3.org/TR/tracking-dnt/

37 http://www.ntia.doc.gov/other-publication/2013/privacy-multistakeholder-process-mobile-application-transparency

38 http://www.ntia.doc.gov/files/ntia/publications/july_25_code_draft.pdf

Strong privacy regulations can help to make consumers feel more confident that their personal data is protected online. They should contain fundamental data protection principles (e.g. purpose limitation) and should provide individuals with rights (e.g. right to access the collected data, right to erase) and adequate safeguards. The latter are particularly relevant in the context of data retention.

The global dimension of online privacy requires concerted action in international fora and the adoption of international binding instruments.

At the level of the regulators

Regulators have a strong role to play in order to ensure that the rules on data protection are respected by market players.

Regulators also need to develop strong cooperation and partnerships with regulators in other countries and regions of the world, in an effort to develop common approaches.

Regulators need to provide guidance for the industry on the interpretation of the legal norms and help industry develop best practices.

Regulators can foster industry-wide codes of practice and be involved in standardisation initiatives.

At the level of the industry

Self-regulation (e.g. codes of conduct) and standardisation initiatives require the involvement of all the parties concerned (industry, governments, civil society, consumers, etc.).

4.2 Security

For all of his activities, the digital consumer will be concerned about the security of his data. For instance:

- What happens if his data is lost by internet companies, online retailers or governments and re-used for fraudulent purposes?
- Who is responsible to ensure the security of data?
- Is there a competent authority to deal with these issues?

Recent cyber attack incidents leading to severe security breaches have shown that these are real questions. Despite this, these simple questions are not easy to answer.

Regulatory landscape

Many countries[39] have in place legislation to criminalise new forms of attacks against information systems such as the illegal interception of computer data, or the spread of malicious software into networks and computers. These laws are useful but do not force operators to protect their systems in the first place, and do not provide particular protection for the digital consumer.

In the European Union at least, there is at the moment no obligation for companies other than telecommunications operators to notify security breaches to customers or to national regulators. The

[39] For instance, in the EU, the relevant directive is Council DIRECTIVE 2013/40/EU of August 12, 2013 on attacks against information systems and repealing Council Framework Decision 2005/222/JHA

European Union is attempting[40] to adopt a new directive which would oblige certain operators ('key internet enablers') to do so but negotiations are difficult.

The proposal would also oblige member states to set up national competent authorities responsible for network and information security and would oblige certain market operators[41] to have in place methods to deal with security risks.

In relation to the role of regulators, the proposal specifies that competent authorities would have the power to require market operators (and public administrations[42]) to:

- provide information needed to assess the security of their network and information security systems , including documented security policies; and
- undergo a security audit carried out by a qualified independent body or national authority and make the results available to the competent authority.

The proposed data protection regulation (mentioned above) is also proposing to extend the obligation to notify competent authorities and affected individuals in case of personal data breaches.

ITU is working with Member States, regions, and in partnership with IMPACT, to deploy capabilities to build capacity at national and regional level, in addition to establishing National Computer Incident Response Teams (CIRTs).

ITU, in collaboration with IMPACT, is helping countries to establish their National Computer Incident Response Team (CIRT), which serves as a national focus point for coordinating cybersecurity incident response to cyber attacks in the country. The objective of the CIRT Assessment is to define the readiness to implement a national CIRT.

ITU-IMPACT has to date completed CIRT assessments for over 50 countries.

Source: ITU: http://www.itu.int/en/ITU-D/Cybersecurity/Pages/Organizational-Structures.aspx

At the regional level, ENISA[43], the European Union Agency for Network and Information Security has been set up to enhance the capability of the EU and its member states and businesses to prevent, address and respond to network and information security problems.

Industry argues that regulatory approaches could hinder private sector innovation and industry should be in charge with ensuring the protection of their systems. Cyber security standards are being developed[44] and this is sufficient, they argue.

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[40] http://ec.europa.eu/digital-agenda/en/news/commission-proposal-directive-concerning-measures-ensure-high-common-level-network-and

[41] The Commission's initial proposal refers to market operators "which enable the provision of other information society services" (an non exhaustive list of operators is included in an annex which lists as an example social networks and search engines), and operators of critical infrastructures that are essential for the maintenance of vital economic and societal activities in the fields of energy, transport, banking, stock exchanges and health. Software and hardware companies would be excluded.

[42] The European Parliament has amended the Commission's draft and has proposed to remove public administrations from the scope of the proposal.

[43] http://www.enisa.europa.eu/about-enisa/activities

[44] See in particular ISO 27001 and 27002, http://www.17799.com/

Conclusions

The digital consumer needs to be assured that his data will be kept secure. There are very few policy responses dealing in a comprehensive manner with the concerns of digital consumers relating to the security of networks and data.

Recommendations

At the level of policymakers

It is difficult to conclude about a possible policy responses given the fact comprehensive strategies are not yet adopted on this question.

Despite this fact, we see that consumers do need at the very least to be informed of data and security breaches. Regulators should also be informed. At the very least, the policy framework should include these elements.

At the level of the regulators

Regulators should be established to deal with issues relating to information and network security. Their tasks can be to:

- provide information on security standards
- audit the security standards of operators
- explain to digital consumers what to do in case of cyber-security attacks
- provide information on new types of viruses, malware etc.

At the level of the industry

Industry should continue to work on the protection of the security of their networks and information systems as a matter of priority.

Even in the absence of a regulatory obligation, industry should be transparent about cyber attacks and inform affected users immediately when their data could be compromised.

4.3 Illegal and harmful content

Digital consumers may come across illegal and harmful content on the internet, for instance in search results or on social media.

Minors need more protection than adults and parents and carers need to make sure that children will not be exposed to violent or other forms of unwanted content. Many operators (ISPs, mobile operators, social networks, search engines) have committed through codes of conduct or on their own initiative to address the problem of harmful content. ISPs and mobile operators usually offer parental controls that need to be activated by subscribers. The main search engines also offer 'safe search' tools to prevent inappropriate content (text, images and videos) to appear in search results.

Despite these initiatives, parents are sometimes not sufficiently digitally literate to know what to do. There is therefore a need for governments, regulatory authorities and market operators to provide information on the available tools and on how to use them.

Digital consumers need to know what to do when faced with illegal and harmful content.

- Who should they report the content to?
- How can the content be removed?
- Where can they seek redress?
- What happens if the content is on a website that is located in another jurisdiction?

These concerns illustrate that the respective roles of courts, police forces, market operators, regulators and victims need to be clearly defined.

Almost all countries have mechanisms in place to deal with illegal content on the internet but it is a complex area of policy since a balance needs to be achieved between freedom of expression on the one hand and the need to fight illegal activities on the internet. Difficulties also occur because:

- What is illegal in one country may not be illegal in another country.
- ISPs, search engine providers and SNS do not want to monitor the internet to detect illegal and harmful content.
- Law enforcement authorities need to be able to detect and take action against illegal acts and this very often requires the collaboration of ISPs, search engines and social networks.

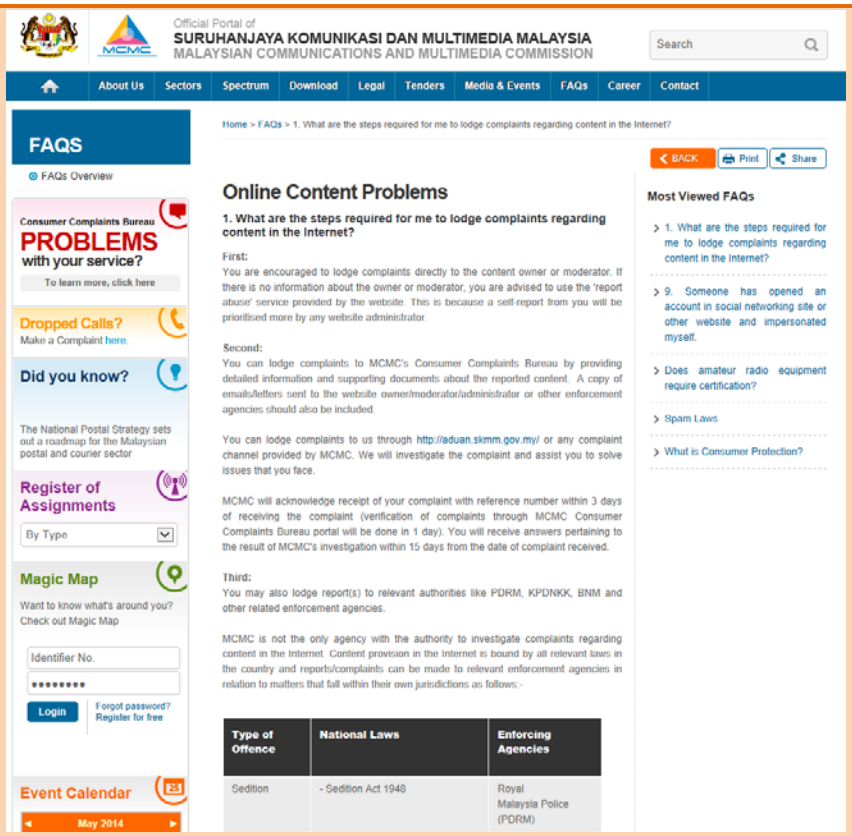
Around the world, laws are being adopted to try to deal with these issues, general laws and also specific rules to deal with special concerns (e.g. fighting online piracy, online child pornography, illegal gambling, etc.).

Self-regulatory frameworks on notice and take down or notice and take-action have also developed to frame the role of internet intermediaries and to ensure that content can easily be removed from websites when it is obviously illegal. In some areas (e.g. fighting online piracy, as explained above) regulators can be involved in the process.

Hotlines exist in many countries for victims to report illegal content. INHOPE[45] is the global network of internet hotlines to respond to reports of illegal content on the internet and to fight sexual abuse material.

Some regulatory authorities around the world are providing information on what to do when facing problem.

[45] http://www.inhope.org/Libraries/Infographics/INHOPE-2013-Inforgraphic.sflb.ashx



Source: website of the Malaysian Communications and Multimedia Commission

Conclusions

The digital consumer deserves at the very least to know what to expect when faced with illegal or harmful content on the internet. Minors are particularly vulnerable and need a higher level of protection than adults.

Many countries are adopting general and specific legislation to deal with illegal and harmful content on the internet. But digital consumers often do not know what to do when they are confronted with illegal and harmful content or conduct on the internet.

Recommendations

At the level of policymakers

Clear rules need to be adopted on the respective duties of internet players (ISPs, search engines, social networks), law enforcement, courts, regulatory authorities and hotlines in the fight against illegal and harmful content on the internet. These laws need to take into account the fact that content will often be located on websites in other jurisdictions.

At the level of the regulators

Regulators have a strong role to play to ensure that digital users receive the information they need. They can act to make sure that internet intermediaries deliver this information directly, but they can also promote this information on their websites.

Regulators can foster industry-wide codes of practice and be involved in standardisation initiatives.

Regulators need to develop strong cooperation and partnerships with regulators in other countries and regions of the world, in an effort to develop common approaches.

At the level of the industry

Industry should provide clear information on:

- the available filters
- how to report illegal or harmful content, and explain the follow up that will be given
- the hotlines that may be established in the country
- the possible involvement of regulators (e.g. AGCOM in Italy on the fight against online piracy as explained below and/or the police.

4.4 Copyright

As illustrated above, the main problems are the lack of availability of creative content in some regions and the increasing amount of online piracy.

The fact that broadband subscriptions continue increasing all over the world (e.g. according to the IFPI Digital Music Report 2014[46], whilst mobile broadband penetration in Sub-Saharan Africa only increased 2% in 2011, it increased 11% in 2013), presents new opportunities for both businesses and consumers, but also creates "a hugely disruptive challenge to the creative industries, especially in the area of digital copyright"[47].

Consumers' organisations generally perceive that efforts are being put by governments and international organisations in protecting the different rightholders (creators, music publishers, audiovisual producers) and fighting against piracy, rather than in taking the necessary initiatives to provide consumers with more access to creative content.

Regulatory landscape and trends

In some cases, the reason for the restrictions described above is the fact that the exercise of intellectual property rights is territorial in nature.

Rightholders, who have the exclusive right to authorise or prohibit the reproduction and the communication of their works, including online, normally exercise their rights on a territorial basis, country by country.

Consequently, providers of online content such as music or video need to clear rights in each country from which they allow access to their services. For example, currently, for an online provider of movies, to serve the US market with a population of 316m involves clearing rights only once, whereas to serve the EU market as a whole with a population of 503m could involve clearing the rights 28 times. The situation becomes even more complicated as very often more than one party have rights on a single copyright work. It goes without saying that sometimes it is not easy for internet providers to know from whom they need to obtain rights' clearance. For instance, an online music store that wants to offer a song will have to

[46] http://www.ifpi.org/downloads/Digital-Music-Report-2014.pdf

[47] In this regard, see ITU GSR11 Discussion paper http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR11/documents/05-Intellectual-property-E.pdf

clear authors' rights (via collecting societies), and the record producer's and performers' rights (via the record producer).

This may inevitably result in market fragmentation, and it is said to impede the emergence of new services. From the consumer perspective, this obviously leads to a lack of availability of legal content. Furthermore, the online provider's higher licensing costs will surely somehow be passed on to the consumer.

The territoriality principle, as well as the copyright framework, is enshrined in international treaties such as the Berne Convention and the World Trade Organisation's Agreement on Trade-Related Aspects of Intellectual Property Rights. A reform of the copyright system is probably needed but is proving difficult to achieve. Some also advocate a complete overhaul of the copyright system but this is unlikely to happen in the foreseeable future as it would require changes to international treaties[48] on which the copyright system is based.

The World International Property Organisation is the main actor regarding copyright in the international sphere. However, WIPO's on-going work in the Standing Committee on Copyright and Related Rights, which gathers representatives from 187 countries, is limited to concrete aspects of copyright, such as harmonizing exceptions and limitations to copyright (e.g. Treaty facilitating access to published works for the visually impaired and facilitating the cross-border exchange of accessible format copies[49]). Also, WIPO is witnessing the confrontation between developed countries, which rely on a strong content industry and do not want to reduce copyright protection, and developing countries, which advocate for more flexible copyright rules as a means to gain more access to creative content and knowledge.

In 2011, the OECD, following a high level meeting, issued a communiqué stating that although the "effective protection of intellectual property rights plays a vital role in spurring innovation and furthers the development of the Internet economy", "Internet policy making principles need to take into account the unique social, technical and economic aspects of the Internet environment"[50]. However, OECD's more concrete actions in the field of copyright have rather focused on piracy of digital content[51].

In the EU, several sectoral initiatives have been taken in order to overcome the rigidity of copyright rules. For instance, the EU has adopted a directive that aims to facilitate the multi-territorial licensing of authors' rights in musical works for online uses. The directive promotes that national authors' collecting societies aggregate their repertoires. The aim is to make it easier for online music services to obtain licences for a multitude of countries and to offer a large catalogue of music to consumers.[52]

Role of regulators

While little can be done to change the licensing of rights on a country-by-country basis, competition law authorities can have a role to play in how right holders grant licences and their action can ultimately improve consumers' access to online content.

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[48] http://www.wipo.int/treaties/en/

[49] http://www.wipo.int/treaties/en/text.jsp?file_id=301016

[50] http://www.oecd.org/internet/innovation/48289796.pdf

[51] http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/piracy-of-digital-content_9789264065437-en#page1

[52] http://europa.eu/rapid/press-release_MEMO-14-80_en.htm

For instance, a system of licences for sports events granting absolute territorial exclusivity to licensees (broadcasters in this case) has been found contrary to competition law by the Court of Justice of the European Union.[53]

More recently, the European Commission launched in 2014 an investigation regarding alleged restrictions between several US rightholders (film studios such as Warner Bros., Sony Pictures, Paramount Pictures) and EU users (pay-TV broadcasters such as Sky Italia (Italy) and Canal Plus (France))[54]. Such alleged restrictions would be included in licensing agreements between the US and the EU companies and would prevent the latter to offer their services across borders, "for example by refusing potential subscribers from other Member States or blocking cross-border access to their services".

At the level of copyright enforcement, telecommunications operators and regulators are increasingly involved in copyright issues, mainly as regards the fight against piracy. For instance, France has set up a special administrative authority, HADOPI[55], to fight online piracy, to promote legal offers and to raise awareness about the consequences of internet piracy. HADOPI has developed powers in relation to individual downloaders, through a so-called graduated response system[56].

Another example can be found in Italy, where a special role has been given to AGCOM, the converged regulator.

New rules on protecting copyright online (in force since March 31, 2014) entrust AGCOM to order selective removal of works (or links/trackers to works) or disabling of website access by ISPs.

The regulation establishes a committee composed of representatives from the different sectors (consumers, rightholders, ISPs, public institutions) to develop and protect the legal offer of digital works and to discuss possible self-regulatory solutions with the aim of supporting the development of digital works.

The take-down procedure starts with the notification of a claim (in a form on AGCOM website) asking AGCOM for the removal of illicit content. AGCOM informs the claimant within 7 days about the start of the procedure or reasoned dismissal of the claim.

The notification about the start of the procedure (sent to the claimant, service providers and website manager, and uploader, if identified) should at least contain a detailed description of the digital works involved; the indication of the copyright law provision allegedly infringed; a brief description of the facts and of the preliminary outcomes of AGCOM investigation; the notice that the receiver of the notice may remove the disputed contents on a voluntary basis.

The parties may file counterclaims within 5 days. In case the recipient makes the necessary adjustments to remove the illicit content or if the claimant brings an action before a court, the procedure will be closed.

The procedure should be closed within 35 days. If AGCOM concludes that a breach has been committed, it will order the service provider to either remove the illicit content or disable access to it (i.e. web-

[53] http://curia.europa.eu/jcms/upload/docs/application/pdf/2011-10/cp110102en.pdf

[54] http://europa.eu/rapid/press-release_IP-14-15_en.htm

[55] http://www.hadopi.fr/

[56] http://www.hadopi.fr/en/new-freedoms-new-responsibilities/graduated-response

blocking). The decision has to be proportionate to the gravity of the violation. Compliance with AGCOM decision must be ensured within 3 days. AGCOM decision can be challenged before an administrative court.

New rules are without prejudice of self-regulatory instruments on notice and take-down procedures put in place by interested parties.

Source: Cullen International

Industry driven initiatives

Some industry initiatives aim at facilitating the licensing of rights in musical works for online purposes. For example in 2000, collecting societies from all over the world signed the Santiago Agreement. This agreement contained reciprocal agreements allowing that a single collecting society granted multi-territorial licences covering the repertoire of the other collecting societies. For providers of online music services, the agreement put in place a one-stop-shop mechanism by which they uniquely had to negotiate with the collecting society of the country where the provider was based. The Santiago Agreement was withdrawn following European Commission's competition concerns[57]. Indeed, the agreement contained membership clauses, which restricted authors' ability to affiliate to the collecting society of their choice; and exclusivity clauses, which provided collecting society with absolute territorial protection regarding other collecting societies. These clauses obliged internet providers to obtain the necessary licences from the collecting society of the country where they wanted to offer their services.

In order to favour multi-territorial licensing solutions for online music, different rightholders are working on a global repertoire database[58]. This initiative may help online music providers to identify who owns and controls musical works, thereby facilitating their licensing tasks. This may result in consumers having more access to more music works in more territories.

In the audiovisual sector, the film producer MIRAMAX and Netflix have signed a licensing agreement covering a number of countries in Latin America and allowing licensing to occur on a regional basis[59].

In order to share content (e.g. videos, songs) and knowledge (e.g. academic works, e-books) whilst respecting copyright, creative common licences are spreading all over the world[60]. Creative common licences are a flexible solution to conciliate the rigid copyright rules with the creator's expectations to reach a wider audience. They normally contain a permission to publicly share and use a given work under certain conditions designed by the creator himself. These licences are also being increasingly used by public institutions and international organisations[61].

Conclusions

Although new online services continue spreading throughout the world, the online market of online content is fragmented and consumers are often discriminated by reason of their physical location.

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[57] http://ec.europa.eu/competition/antitrust/cases/dec_docs/38698/38698_4567_1.pdf

[58] http://www.globalrepertoiredatabase.com/

[59] http://ir.netflix.com/faq.cfm

[60] http://creativecommons.org/about

[61] http://www.wipo.int/pressroom/en/articles/2013/article_0026.html

The focus should be put in improving licensing practices, i.e multi-territorial licensing. The territoriality principle does not prevent rightholders from granting multi-territorial licences.

The challenge is to conciliate the righholders' right to be properly remunerated with the consumers' expectations to enjoy an attractive legal offer of online content wherever they are.

As commissioner Viviane Reding said in relation to European consumers, "consumer rights online should not depend on where a company or website is based. National borders should no longer complicate (...) consumers' lives when they go online to buy a book or download a song"[62].

Recommendations

At the level of policymakers

The debate on the adequacy of the existing copyright rules to the online environment has to be brought in regional and international fora, as it is happening in the EU.

Educational campaigns should be promoted in order to educate consumers to the respect of intellectual property rights.

At the level of regulators

Competition authorities play a key role in ensuring that certain rightholders do not put barriers to cross-border online services.

Regulators could become more involved in copyright enforcement. They are the appropriate actors to build bridges between rightholders, intermediaries and consumers (e.g. they can coordinate multistakeholder, fast and efficient mechanisms to take down illegal content).

At the level of the industry

Rightholders should explore new licensing solutions, especially for audiovisual content.

Online service providers should not add additional barriers to e-commerce, i.e. if they acquire multi-territorial licences they should develop multi-territorial online stores for consumers (in the EU, a single online music store instead of 28).

4.5 Net neutrality

Net neutrality in its simplest definition means that digital consumers should not find that their access to, and use of, specific apps, content or services is blocked or slowed down by their broadband access provider – provided that the content is legal.

Net neutrality is therefore an issue relevant to many of the services used by digital consumers discussed in this paper.

Regulatory responses

There have been three types of regulatory responses:

- requiring broadband access providers to be transparent about their traffic management practices;
- imposing a legal requirement for net neutrality;

[62] http://europa.eu/rapid/press-release_IP-09-702_en.htm

- the 'do nothing' approach.

At the European Union level, broadband access providers are required to explain clearly and simply on their websites and in their contracts:

- any conditions limiting access to, and use of, apps, content or services;
- the traffic management practices they apply and the impact on service quality.

The EU is proposing to go beyond such transparency requirements and to impose a EU-wide net neutrality rule: blocking or slowing down access to apps, content or services by ISPs for anti-competitive reasons would be prohibited.[63] Traffic management would still be allowed for legitimate reasons, such as managing peak loads, provided it is applied in a non-discriminatory way. It is expected that the proposal will be adopted at the end of 2014 or start of 2015.

Laws requiring net neutrality have already been adopted in two European countries – the Netherlands[64] and Slovenia[65].

In the US, the Federal Communications Commission (FCC) on May 15, 2014 opened a public consultation on proposals to replace the net neutrality rules contained in its 2010 Open Internet Order that were (partly) revoked by a court decision in January 2014[66].

In Latin America, laws requiring net neutrality have been adopted in Chile[67] and Colombia[68].

Recently the net neutrality question has shifted focus from blocking/slowing down access to whether broadband providers should be allowed to charge content companies for preferential treatment to reach customers at higher speeds or quality (so called “fast lanes”).

In February 2014 Netflix and the US cable operator Comcast struck a landmark deal in which Netflix would pay an undisclosed fee for faster access to Comcast customers[69].

Here clear rules have yet to be established.

In the US, the revised Open Internet proposals adopted by the FCC on May 15,2014 address the question of fast lanes and the conditions under which they would be acceptable. The FCC has put forward a proposal to allow ISPs to charge companies to reach customers at faster speeds but only if they meet a new standard of “commercial reasonableness” that will be judged by the FCC on a case-by-case basis.

The EU is proposing that in addition to regular, best-effort internet access, broadband access providers are allowed to offer “specialised services” requiring a defined quality of service or dedicated capacity as long as those services do not impair the quality of internet access services. Under the proposed EU

[63] http://ec.europa.eu/digital-agenda/en/connected-continent-legislative-package

[64] Article 7.4(a) of Telecommunications Law. http://www.government.nl/documents-and-publications/notes/2012/06/07/dutch-telecommunications-act.html

[65] Article 203 of Electronic Communications Act. http://www.scribd.com/doc/144614369/Slovenia-Net-Neutrality-law-2012

[66] http://www.fcc.gov/document/fcc-launches-broad-rulemaking-protect-and-promote-open-internet

[67] http://www.leychile.cl/Navegar?idNorma=1016570&buscar=NEUTRALIDAD+DE+RED

[68] https://www.dnp.gov.co/LinkClick.aspx?fileticket=tYD8BLf-2-g%3D&tabid=1238

[69] http://www.ft.com/intl/cms/s/0/60a27b18-9cc4-11e3-b535-00144feab7de.html#axzz31gCtDVc4

definition, specialised services operate in closed networks, e.g. IPTV, and are not used as a substitute to full internet access services.[70]

Recommendations

At the level of policy makers

Policy makers should define a clear set of rules on net neutrality covering both regular internet access and paid-for fast lanes.

At the level of regulators

Regulators should monitor the enforcement of these rules and provide guidance on their implementation. For example, regulators can define what is the minimum quality of service acceptable for regular internet access and what are fair and reasonable conditions for selling fast lane access.

At the level of the industry

Broadband access providers should act transparently both towards broadband users and content companies. Users should be able to easily understand the traffic management policies that apply to the broadband subscription they buy.

Fast lanes should be offered in an open and transparent way to all content companies that may be interested in using them, including at fair and non-discriminatory prices and other terms and conditions.

4.6 Payments

We identified above that consumers need to be confident that new methods of payment will be trustworthy.

This is an area for policy makers and regulators, as some of these new methods of payments are not offered by the usual 'regulated' entities but by new entrants, which do not necessarily abide by the same set of rules and regulations.

EU policy makers are seeking to make sure that operators providing these services are supervised by national competent authorities and provide the same guarantees as payment services offered by banks and credit card companies[71].

The OECD Committee on Consumer Policy very recently issued[72] policy guidance to boost consumer protection when using mobile and on-line payment systems and to identify ways in which policy makers and businesses can work together to strengthen consumer protection while also ensuring innovation in the marketplace.

For instance to ensure the security of payments, the OECD policy guidance specifies that:

- Payment providers should put in place appropriate safeguards to protect the security of their systems, and should encourage the adoption of such measures by all entities having access to consumer data related to payments

[70] http://ec.europa.eu/digital-agenda/en/connected-continent-legislative-package

[71] http://europa.eu/rapid/press-release_MEMO-13-719_en.htm?locale=en

72 March 28, 2014, http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=dsti/cp(2011)24/final&doclanguage=en

- In addition to notifying consumers, payment providers should provide them with timely and effective redress mechanisms when their data is compromised and/or they suffer financial losses caused by security breaches
- Stakeholders should work together to raise consumer awareness about payment security issues, and about the actions that consumers can take to protect themselves in such transactions.

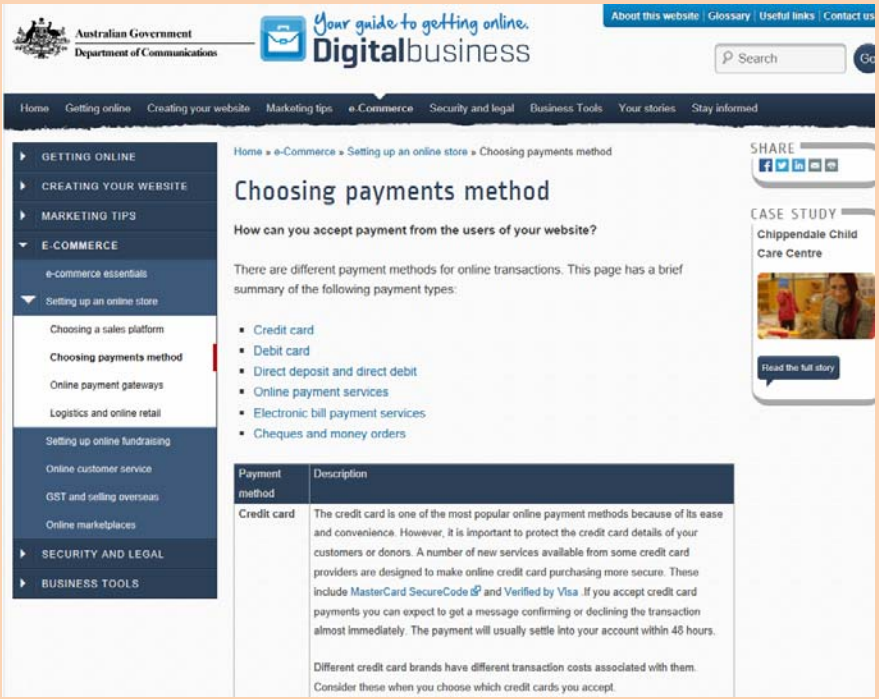
Regarding surcharges for card payments, competition authorities around the world (Australia, EU, US) have taken action to lower the interchange fees set by the two leading card schemes Visa and MasterCard.

The EU is adopting legislation that would cap the level of interchange fees across the 28-nation bloc. It would also prohibit retailers from applying surcharges to such card payments (because the interchange fees would have been significantly lowered by the cap)[73].

Note also that Australia's Government Department of Communications is providing information of the different methods of payment on its website.

[73] http://europa.eu/rapid/press-release_MEMO-13-719_en.htm

Australian's Government Department of Communications lists on its website[74] the different payment methods for online transactions, with tips for online retailers on what to look out for, including on the need to protect the payment details of customers as they are sensitive pieces of information.



4.7 Consumer rights and trust

The policy responses

A strong set of consumer rights can help to protect digital consumers when they buy goods and services online.

These rights include:

- Information on who is operating the website
- Protection against unfair commercial practices, leading consumers into purchasing a good they would not have bought without having been unlawfully led into the transaction
- Clear information on the ordering process
- Price transparency. No hidden extra charges
- Right to cancel a sales contract within a cooling off period, including the right to return goods and obtain a refund

[74] http://www.digitalbusiness.gov.au/e-commerce/setting-up-an-online-store/choosing-your-payments-method/

- Information on when the goods will be delivered and on the cost of delivery and return of the goods
- Information on how digital goods such as music, films or software can be listened to/viewed or downloaded, and whether they can be used on multiple devices
- Easy to use complaint handling and dispute resolution procedures.

Online retailers can guarantee these rights in their standard terms and conditions. Trustmarks (see below) can also serve to inform consumers that these basic core rights are guaranteed.

Laws can also be adopted to guarantee that consumers are always granted these rights. This is what many countries have already done. EU's consumer rights Directive for instance gives a core set of rights to EU citizens when they buy from EU-based online retailers[75].

A step further could also be achieved by adopting standard contracts to which digital consumers and online sellers could decide to adhere to on a voluntary basis and which would govern their entire online relationship. This is what the European Union is trying to do, with the adoption of a regulation[76] on a common European sales law. Negotiations are long and difficult though. The initiative is innovative as the parties to an online sales contract would be able to decide to be exclusively governed by the rules of the European sales law, thereby by-passing national legal regimes and the standard terms and conditions of the online retailer.

Trusmarks

One of the main concerns of digital consumers is that they must feel confident and trust the website from which they are ordering a good or a service. This is very likely to be the case, when they purchase from well-known e-commerce sites such as Amazon, but they may be less sure when making purchases from other sites, particularly if the site is in a foreign country.

Trustmarks can re-assure consumers of their reliability. They show that a website complies with a set of service quality and security requirements.

Trustmark schemes can be run by government bodies, non-profit organisations, industry or trade organisations, or by private businesses.

[75] http://ec.europa.eu/justice/consumer-marketing/rights-contracts/directive/index_en.htm

[76] http://ec.europa.eu/justice/contract/files/common_sales_law/regulation_sales_law_en.pdf

Example of a widely used trustmark on UK websites

SafeBuy certifies that shoppers can trust a website because the retailer adheres to the rules and regulations on distance selling but also more generally, on privacy protection, child protection and security of payment transactions[77].

However, a multitude of trustmarks have appeared, leading to a so-called "trustmark jungle" leaving consumers confused as to which ones they can trust. Furthermore, most trustmarks operate at a national level[78].

The development of internationally recognised trustmarks would help to boost the e-commerce market.

The EU is currently assessing how to reach an EU-wide trust mark scheme and to establish cooperation platforms on the governance of trust mark systems[79].

We see here that regulators could have a role to play to foster the establishment of trustmarks and they could also supervise or approve their operation, thereby increasing the level of trust.

Conclusions and recommendations

- Clear rights and obligations should be given to consumers in the laws.
- Given the increasing number of cross-border transactions, supra-national and regional laws should be adopted to give consumers the same rights when they shop from foreign websites, compared to when they shop domestically.
- Regulators should provide clear information on the rights and obligations of digital consumers
- Regulators have a role to play to foster the development of easily recognisable trustmarks in collaboration with the industry and consumer organisations
- Regulators could take a leading role in the supervision and operation of the trustmark systems

4.8 Delivery

Digital consumers need to be assured that they receive their ordered goods on time and in good order. There is usually no problem for national transactions.

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[77] https://www.safebuy.org.uk/index.html

[78] http://www.konsumenteuropa.se/en/News/Press-releases/Press-releases-2013/Important-to-be-able-to-trust-a-trust-mark/

[79] http://ec.europa.eu/digital-agenda/en/news/eu-online-trustmarks-—-building-digital-confidence-europe-smart-20110022

The European Commission published a roadmap at the end of 2013[80] which highlights in particular the need for more transparency and information on the available delivery options, for more, better and more affordable delivery solutions and for enhanced complaint handling and redress mechanisms for consumers, which should be jointly ensured by delivery operators, e-retailers and consumer associations.

4.9 Consumer redress and consumer education

Even if a strong set of rights are given to consumers, a key aspect is to make sure that consumers can seek redress when things go wrong.

As illustrated by BEUC, the European consumer protection authority, consumer redress remains an issue, especially in a dispute between a consumer located in country A, and an online retailer established in country B.

BEUC statement about enforcement:

'The lack of effective enforcement is a key problem in consumer protection. At the same time, it is a complex problem to tackle, as effective enforcement depends on multiple factors such as the enforcement structure and traditions at national level, strong public authorities; the economic climate; the strength and experience of consumer organisations; the possibility for easy redress etc.

In addition to national or cross-border instances, more and more infringements are of a genuinely European dimension, for instance when a large company targets consumers in many EU member states with the same or similar unfair practices.

We therefore need more cooperation among various enforcement bodies and organisations as well as to strengthen the powers and sanctions available to them'.

Source: BEUC website[81]

The OECD adopted a recommendation[82] on consumer dispute resolution and redress in 2007, which proposes common principles for member countries on mechanisms for consumers to resolve disputes and obtain redress for economic harm, including when the purchase goods and services across borders.

It provides that member countries should review their existing dispute resolution and redress frameworks to ensure that they provide consumers with access to fair, easy to use, timely, and effective dispute resolution and redress without unnecessary cost or burden.

Member countries should encourage businesses and industry groups to provide consumers with voluntary mechanisms to informally, and at the earliest possible stages, resolve their disputes and obtain redress as appropriate.

In many countries, formal complaint processes have been established through which individuals or groups of individuals can bring problems to the attention of consumer protection authorities. The OECD's

[80] http://europa.eu/rapid/press-release_IP-13-1254_en.htm?locale=en

[81] http://www.beuc.eu/consumer-rights-and-enforcement/enforcement

[82] http://www.oecd.org/internet/consumer/38960101.pdf

Consumer Protection Policy Toolkit[83] refers to concrete examples in Belgium, Chile, Denmark, Finland, France, Korea, Sweden, Switzerland and the United States.

OECD policy guidance on mobile and online payments specifies that:

'Governments, payment providers, merchants and other stakeholders should develop low-cost, easy to use alternative dispute resolution and redress mechanisms which would, inter alia, facilitate resolving claims over payments involving low-value transactions. Such mechanisms could include the development of effective online dispute resolution systems. Alternative dispute resolution and redress mechanisms should not prevent parties from pursuing other forms of redress, as permitted by applicable law'

Source: OECD[84]

Consumer education

Educating consumers about their rights and how to use them is becoming a priority for many governments.

The European Commission regularly publishes for the EU 28 member states a scoreboard[85] showing how the European Union is performing in relation to EU consumers and warning of potential problems.

The July 2013 edition of the Consumer Conditions Scoreboard highlights that a significant number of European consumers do not know their rights and how to use them. 'Only 12%of respondents were able to answer correctly four questions testing their basic consumer knowledge'.

This reveals the need to launch information and education campaigns, and this is clearly a role for governments and regulators.

Consumers International[86], the world federation of consumer groups, has translated this into a right to consumer education, i.e. a right to acquire knowledge and skills needed to make informed, confident choices about goods and services, while being aware of basic consumer rights and responsibilities and how to act on them.

Conclusions and recommendations

Contrary to other areas, consumer education and redress does not demand a change of laws. Government and/or regulators can do a lot to improve the situation. For instance, they can:

- provide information to citizens on their rights and obligations through education campaigns and by providing clear information on their websites
- receive complaints from consumers by operating online complaint-submission mechanisms
- provide information on the available dispute resolution mechanisms
- approve industry mechanisms to ensure redress

[83] OECD Consumer Protection Policy Toolkit, 2010, http://www.keepeek.com/Digital-Asset-Management/oecd/governance/consumer-policy-toolkit_9789264079663-en#page2

[84] http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=dsti/cp(2011)24/final&doclanguage=en

[85] http://ec.europa.eu/consumers/consumer_research/editions/docs/9th_edition_scoreboard_en.pdf

[86] http://www.consumersinternational.org/who-we-are/about-us/

5. Targeted initiatives - specific market players

In this section, we describe some recent interventions that are aimed at addressing the conduct of new market players, which have become particularly important in the e-commerce ecosystem. Some of these are regulatory interventions, while others are driven by the market players themselves or are private-public partnerships.

Search engines

Sector specific rules (e.g. on privacy) apply to many of the activities of search engines, but like most operators in the e-commerce ecosystem, search engines are not 'regulated' to the same extent as other types of operator like telecommunications operators, financial institutions or postal operators. There is no single law that covers the activity of search engines.

In the absence of specific ex ante regulation, competition law is quite often the only remedy available against search engine providers that may be abusing a dominant market position. The FTC and the European Commission have recently carried out investigations relating to some of Google's practices but arrived at different conclusions

The European Commission has used its competition law enforcement powers to investigate Google for an alleged abuse of a dominant position in online search and search advertising[87].

One of the main concerns was that Google was discriminating in favour of its own specialised search services on its web page (e.g. specialised search services for flights or hotels). Search engines that focus on narrowly defined categories of content such as flights or hotels are referred to as “vertical” search engines as opposed to general purpose or “horizontal” search engines.

In order to avoid a potential fine of up to 10% of its annual worldwide turnover, Google made commitments including relating to the comparable display of specialised search services offered by rivals. Google has accepted to guarantee that whenever it promotes its own specialised search services on its web page, the services of three rivals, selected through an auction, will also be displayed in a way that is clearly visible to users and comparable to the way in which Google displays its own services.

When finally approved, the deal will mean that people who search on Google’s local sites in Europe will see results laid out differently from those in other countries.

In the US, a similar investigation by the Federal Trade Commission of Google’s vertical search business was closed in January 2013 without sanctions. The FTC concluded that Google’s actions to promote its own vertical content on the Google search results page was “a product design change with a legitimate business justification” to improve the overall quality of Google’s search product, rather than to intentionally harm competitors[88].

[87] http://europa.eu/rapid/press-release_IP-14-116_en.htm

[88] http://www.ftc.gov/system/files/documents/public_statements/295971/130103googlesearchstmtofcomm.pdf

Online games and in app purchases

Regarding apps, a number of interventions have taken place in recent months to frame the way in which app service providers are offering their services.

In the EU, the network of national consumer protection enforcement authorities has developed four principles on online games and in-app purchases[89]:

- Games advertised as "free" should not mislead consumers about the true costs involved.
- Games should not contain direct exhortations to children to buy items in a game or to persuade an adult to buy items for them.
- Consumers should be adequately informed about the payment arrangements and purchases should not be debited through default settings without the consumers' explicit consent.
- Traders should provide an email address so that consumers can contact them in case of queries or complaints.

In the US, the Federal Trade Commission has taken action against Apple for unfairly charging consumers for in-app purchases incurred by children without their parents' consent. Apple failed to notify parents that entering their password would approve a purchase and then open a 15-minute window in which unlimited charges could be made without further authentication. Apple was required to change its billing practices by end March 2014 and to pay refunds totalling $32.5m[90].

A lawsuit is open against Google in the US regarding a similar 30-minute window in which in-app purchases can be made without further authentication in games apps purchased from its Play store[91].

Social media

Industry has developed self-regulation in the area of the protection of children. Examples of self-regulatory initiatives in Europe taken under the umbrella of the EU safer internet programme include[92]:

- CEO coalition to make the internet a better place for kids.
- The safer social networking principles for the EU[93].
- European framework for safer mobile use by younger teenagers and children.

The safer social networking principles for the EU highlight highlights the importance of the respective roles of parents, teachers (and other carers), governments and public bodies, law enforcement, civil society and the users themselves. They say that governments and public bodies should:

- Provide children and young people with the knowledge and skills to navigate the internet safely
- Make sure that e-safety curricula are delivered in schools

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89 http://europa.eu/rapid/press-release_IP-14-187_en.htm

90 http://www.ftc.gov/news-events/press-releases/2014/03/ftc-approves-final-order-case-about-apple-inc-charging-kids-app

91 http://www.theguardian.com/technology/2014/mar/11/google-us-lawsuit-in-app-purchases

92 http://ec.europa.eu/digital-agenda/en/self-regulation-better-internet-kids

93 https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/sn_principles.pdf

- Ensure that law enforcement agents are equipped with appropriate training, tools and resources needed to combat criminal activity conducted online
- Work together to ensure that frameworks for cross-border coordination are effective and efficient

Cloud

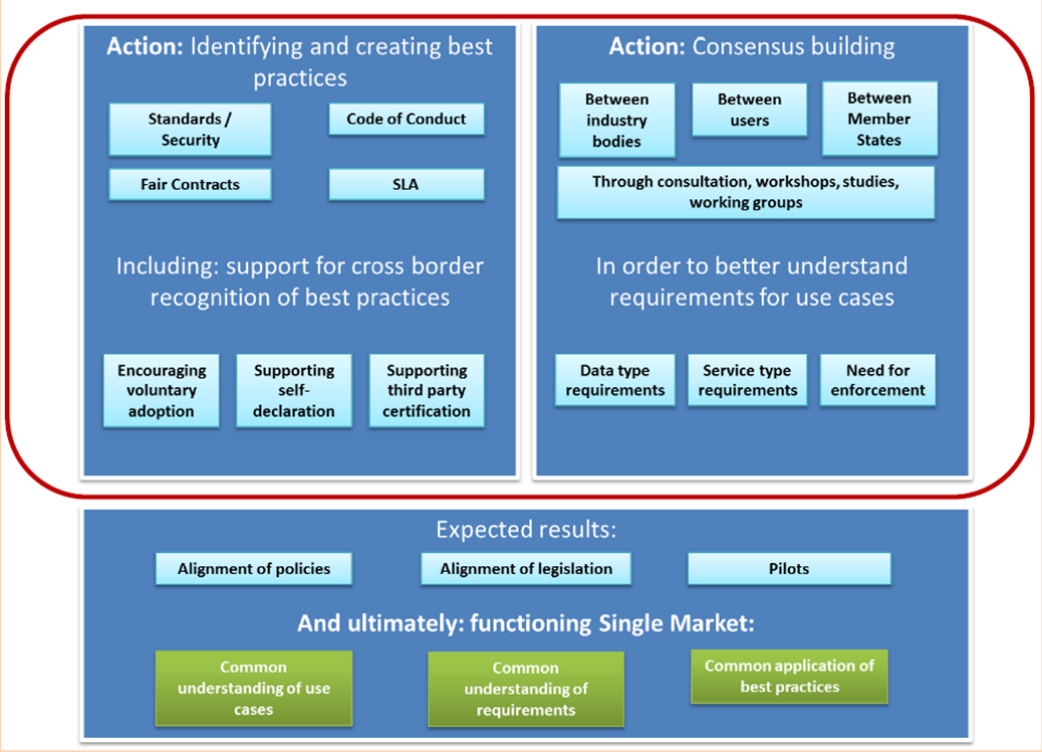
In order to boost trust and confidence in cloud services, industry and public-private partnerships can develop best practices.

The European Cloud Partnership is an example. It brings together industry and the public sector to develop a set of "non-legislative, voluntary measures" for a Trusted Cloud Europe.[94] Best practices are being developed covering legal and operational guidelines as well as technical standards. These include a code of conduct on data protection, model safe and fair contract terms and conditions, and model terms for service level agreements.

Cloud providers could voluntarily adopt the best practices, and would then be able to market their services as complying with the Trusted Cloud Europe framework.

[94] http://europa.eu/rapid/press-release_IP-14-296_en.htm

Figure 10 - Trusted Cloud Europe framework



The following table illustrates the initiatives taken by some countries to promote and frame cloud computing.

Country	*Initiative taken to promote cloud computing*
Germany	Trusted cloud Funding initiative of the Federal Ministry of Education and Research in data protection, data security, privacy, identity and access management in cloud services (also for setting up guidelines)
Spain	Cloud computing Challenges and opportunities adopted by ONTSI (National Observatory for Telecommunications and Information Society) in 2012. Study analysing the economic, social and environmental impact of cloud computing in Spain.
France	Investment by the state in two important cloud computing services : Cloudwatt by Orange and Thalès and Numergy by SFR and Bull
Italy	Digital agenda for Italy includes references on how to develop cloud computing in Italy DigitPA recommendations on the use of cloud computing in the public administration
United Kingdom	G-Cloud Programme Cross government initiative led by Ministry of Justice introducing cloud ICT services into public sector (government, local authorities). The 4th version of the G-Cloud went live on October 29, 2013 with

	1,000 businesses offering about 13,000 services to public sector buyers.
Australia	The Australian Computer Society was asked by the government to investigate the case for a voluntary Cloud Protocol. Conclusion (November 2013): no demand from main cloud suppliers to participate, therefore a voluntary code will be ineffective[95].
New Zealand	Voluntary Cloud Computing Code of Practice developed and operated by the Institute of IT Professionals New Zealand. Cloud providers that sign-up to the code have to disclose important details about their cloud products and services upfront. The code lists the information that must be disclosed, e.g. security standards and practices followed, location(s) where data is hosted, how consumers can access data both during service and after the service has ceased, format and costs for data transportability, etc. The disclosures are reviewed by the body that operates the code ("the CloudCode team"), which also resolves disputes. Signatories can use a special logo.

Source: Cullen Research

6. Conclusion

A largely non-regulated eco-system

Contrary to the telecommunications, energy, postal, financial or audiovisual sectors, many of the operators in the online eco-system are unregulated actors. No single regulator or authority in a country is responsible to supervise and enforce a set of binding rules on these operators. Facebook, Google, Amazon, Yahoo need to respect the laws of the country in which they operate but they are not supervised to the same extent as telecommunications operators or financial institutions.

We have covered some of the most burning cross-cutting regulatory questions that should be addressed as a matter of priority to ensure that digital consumers are fully empowered.

Some of these areas may require changes to the legislative framework. We have tried to show that some regulators around the world are picking up on some important new roles and that there is scope for an accrued role to be played by them.

[95] http://www.acs.org.au/information-resources/public-policy/2013-australian-cloud-protocol and http://www.acs.org.au/__data/assets/pdf_file/0017/27800/ACS-Cloud-Protocol-Consultation-Report.pdf

Annex 1 / Appendix 1 (if needed)

GSR discussion paper

Why Competition Matters and How to Foster It in the Dynamic ICT Sector

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 20 June 2014.

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Why Competition Matters and How to Foster It in the Dynamic ICT Sector

Authors: Janet Hernandez and Kari Ballot-Lena, Telecommunications Management Group, Inc. (TMG)

1 INTRODUCTION

Over the last three decades, laws and regulations designed to introduce and promote competition have been a crucial catalyst in the booming global information and communications technology (ICT) sector. At the early stages of competition, government authorities are generally faced with issues related to licensing, interconnection, and access. As competition increases and markets mature, government authorities must monitor these issues, but may also face concerns related to consolidation and horizontal and vertical integration, as well as consumer issues regarding lock-in, transparency, and quality of service.

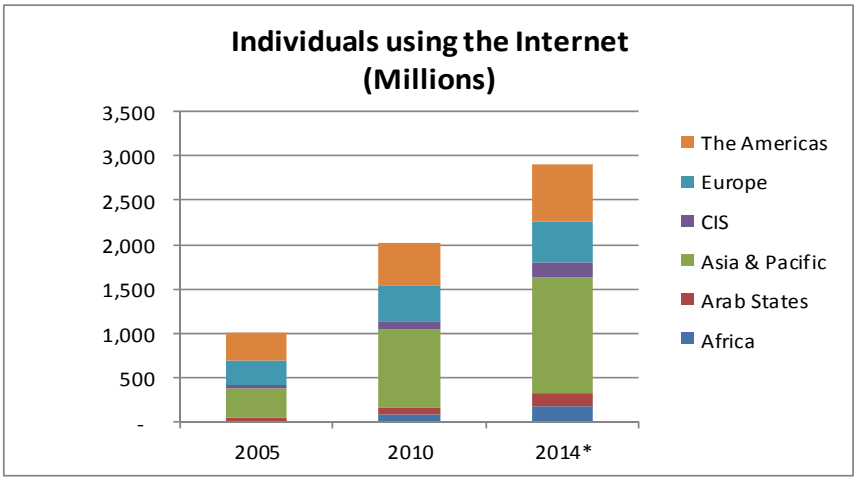
Today's emerging broadband-centric environment is presenting lawmakers and ICT regulators with a new set of challenges. They must address traditional competition issues, but often with new twists resulting from new players, greater consolidation, and integration among telecommunication service providers, content providers, and manufacturers. The rise of Internet protocol (IP) based networks and the separation of services from the underlying physical infrastructure has unleashed a variety of innovative applications and services and new business models that challenge old revenue streams and legacy regulatory regimes. In this new environment, regulators must find ways to adapt their rules to ensure fair competition, drive investment and innovation and protect consumers.

These issues are only likely to increase over time, as more services and economic and social activity move online. This trend is illustrated in the growth of data traffic over the last decade. Between 2002 and 2012, global Internet traffic increased 120 times, now amounting to 12,000 gigabytes (GB) of information being transmitted per second.[1] Today, a fifth of Internet traffic is cross-border.[2] By 2017, estimates are that global Internet traffic will reach 35,000 GB per second, nearly a 350 fold increase from 2002, reaching three times more traffic than in 2012. Today, 40 per cent of the global population is using the Internet and notably the most significant growth is in emerging markets such as Africa and Arab States -- growth between the years 2005 and 2014 was 934 per cent and 480 per cent, respectively. (See Figure 1).

[1] Cisco VNI, "The Zettabyte Era – Trends and Analysis," May 2013, *available at* http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.html

[2] Global flows in a digital age: How trade, finance, people, and data connect the world economy, McKinsey Global Institute, April 2014.

Figure 1: Individuals Using the Internet



Source: ITU World Telecommunication/ICT Indicators database.

This paper examines the increasing complexity of devising an effective, yet flexible, framework to promote effective competition and consumer choice in the rapidly changing ICT sector. Section 2 addresses the impact of competition and the benefits that can ensue in a competitive ICT environment. Section 3 addresses the emerging competitive landscape; Section 4 identifies the key existing and emerging competition issues and how regulators are seeking to address them. Section 5 presents the overall conclusions of this paper.

2 WHY COMPETITION MATTERS

Competition is a key element in realizing the benefits that advanced networks and services can bring. Monopoly markets, even those with strong regulatory oversight, are often characterized by high prices, poor quality of service and limited innovation. Providers in such a situation are often slow to develop new services in response to evolving consumer demand. By contrast, more competitive markets force more attention to be paid to consumer needs, driving prices down and service quality and innovation up.

Reflecting an increasing realization of the benefits of competition, the global ICT sector has overwhelmingly moved from one based on monopolies towards fully competitive markets for a variety of services and across technologies. The existence of multiple players in a market, rather than one sole provider, has been shown to benefit consumers as companies compete for customers by lowering prices, improving service quality, and introducing new technologies and services. Importantly, effective competition reduces the need for *ex ante* regulatory interventions at each level of the service supply chain, including the international gateway, national and regional backbone networks, and the local access market.

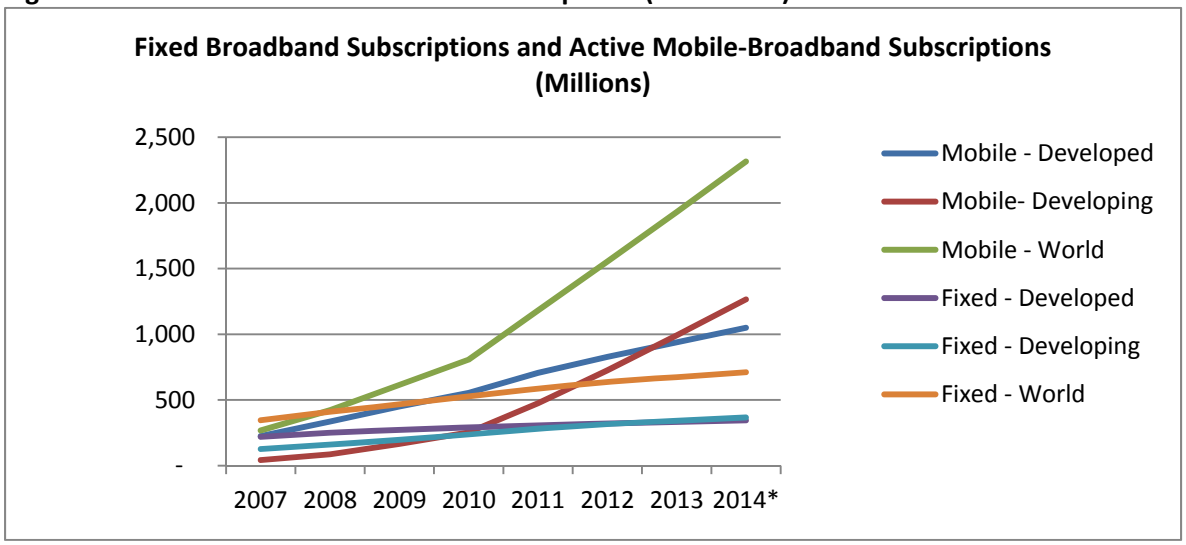
On the technology side, having multiple competitors increases the supply of network infrastructure, giving consumers more choice and making services more affordable. For example, based on ITU statistics, between 2004 and 2013, the percentage of countries worldwide with partial or full competition in the international gateway market increased from 55 per cent to 84 per cent.[3] Likewise,

[3] ITU World Telecommunication/ICT indicators database, www.itu.int/icteye.

the percentage of countries with partial or full competition in the DSL market rose from 59 per cent to 82 per cent between 2004 and 2013.[4] In addition, new business models, new players, and new services are creating an unprecedented amount of choice for consumers. In a competitive environment, consumers are able to choose not only amongst network service providers for fixed line and mobile telephony and broadband services, but also among an emerging array of new providers that offer "over the top" (OTT) services.

Competition is also key to ensuring widespread access to and adoption of ICT services, particularly broadband services. As reported by the UN Broadband Commission, a study of 165 countries between 2001 and 2012 revealed that countries with competitive markets had average broadband penetration levels 1.4 per cent higher for fixed line broadband and up to 26.5 per cent higher for mobile broadband than those countries without competitive markets.[5] The correlation between liberalization and penetration is particularly notable in the mobile market. The precipitous rise in the number of mobile connections between 2005 and 2013 tracks the increase in fully competitive mobile markets.

Figure 2: Fixed and Mobile Broadband Subscriptions (2007-2014)



Source: ITU World Telecommunication/ICT Indicators database.

The mobile services market in Costa Rica, for example, illustrates how competition helps the ICT sector grow. In 2011, two new mobile operators, as well as two mobile virtual network operators (MVNOs), entered the market to compete with the monopoly incumbent provider. Since then, penetration and traffic have steadily increased, while prices have decreased (see Box 1).

Box 1: Effects of liberalization and introduction of competition: Case of mobile services in Costa Rica

Recent market liberalization in Costa Rica's mobile market highlights the benefits of competition for consumers. In 2011, the Costa Rican government introduced competition into its mobile market with the assignment of two mobile network operator licenses (Telefonica Moviles and America Movil) and two mobile virtual network operator licenses (Tuyo Movil and Fullmovil). These operators launched

[4] ITU World Telecommunication/ICT indicators database, www.itu.int/icteye.

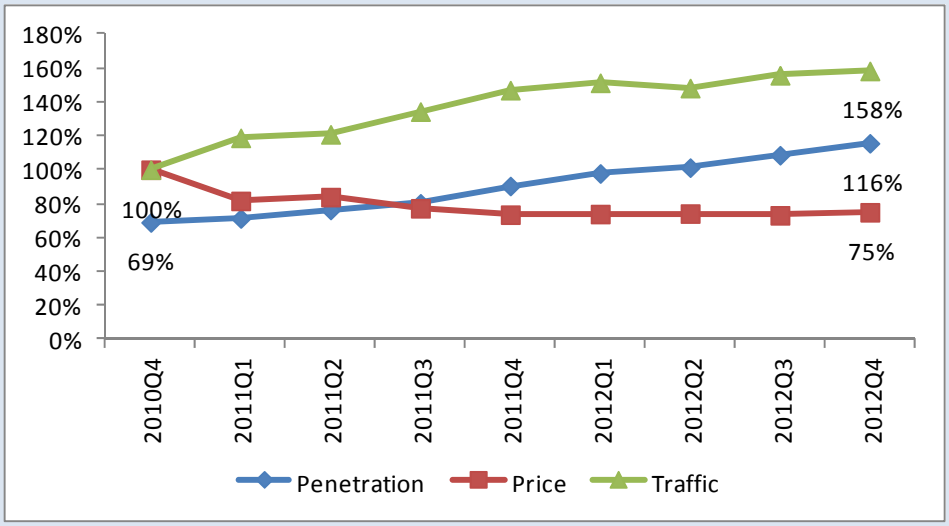
[5] UN Broadband Commission for Digital Development, "The State of Broadband 2013: Universalizing broadband," p. 78, September 2013, http://www.broadbandcommission.org/Documents/bb-annualreport2013.pdf.

service between the third and fourth quarters of 2011 to compete with state-owned incumbent, Instituto Costarricense de Electricidad (ICE).

The introduction of competition was triggered by Costa Rica's commitments under the Dominican Republic-Central American Free Trade Agreement (CAFTA-DR) with the United States that required mobile market liberalization and led to the passing of the General Telecommunications Law (Law 8642 of 30 June 2008). At that the time the law was passed, mobile penetration in Costa Rica was around 43 subscriptions per 100 inhabitants, the lowest in Central America.

In fact, the impact of competition in Costa Rica was felt even before the actual entry of competitors into the market. In preparation for the new competitors, ICE made a significant push to increase service take up and reduce prices—and these gains for consumers have been maintained or increased following entry. As shown in Figure , key market metrics have changed significantly between the fourth quarter of 2010 (nine months before entry occurred) and the fourth quarter of 2012 (one year after entry). In that period, mobile service penetration increased from 69 per cent to 116 per cent, prices per minute dropped by about 25 per cent and, as would be expected, usage increased by about 58 per cent. These figures highlight how the threat of imminent competition, as well as actual competition in the market, leads to clear benefits for consumers in the form of increased choice, lower prices, and higher take-up and consumption.

Figure 3: Key Mobile Market Metrics for Costa Rica



Note: Penetration represents the number of subscriptions per 100 inhabitants. Prices are based on the average revenue per minute of mobile voice traffic. Traffic represents total mobile traffic reported by operators.

Source: Authors based on SUTEL statistical data report.

Today, two-thirds of the world's population has a mobile phone, with global mobile data traffic increasing 81 per cent in 2013.[6] What is particularly notable is that the growth in mobile broadband subscriptions is greater in developing countries than in developed countries; the growth between 2007 and 2014 was almost 2850 per cent – almost eight times the average rate of growth for developed

[6] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018, February 5, 2014.

countries. The beneficiaries of this dynamic marketplace are generally the consumers who are offered better and more alternatives in terms of their offerings.

3 A CHANGING COMPETITIVE LANDSCAPE

The competitive landscape in the ICT sector has changed dramatically, particularly in the last several years. 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. Competition from these new entrants, models and services are forcing traditional service provider to adapt, and adapt quickly. This section discusses the changes that are taking place in the ICT sector and how these changes are impacting the competitive environment.

3.1.1 What's happening?

3.1.2 Convergence creates new competitors and regulatory complexity

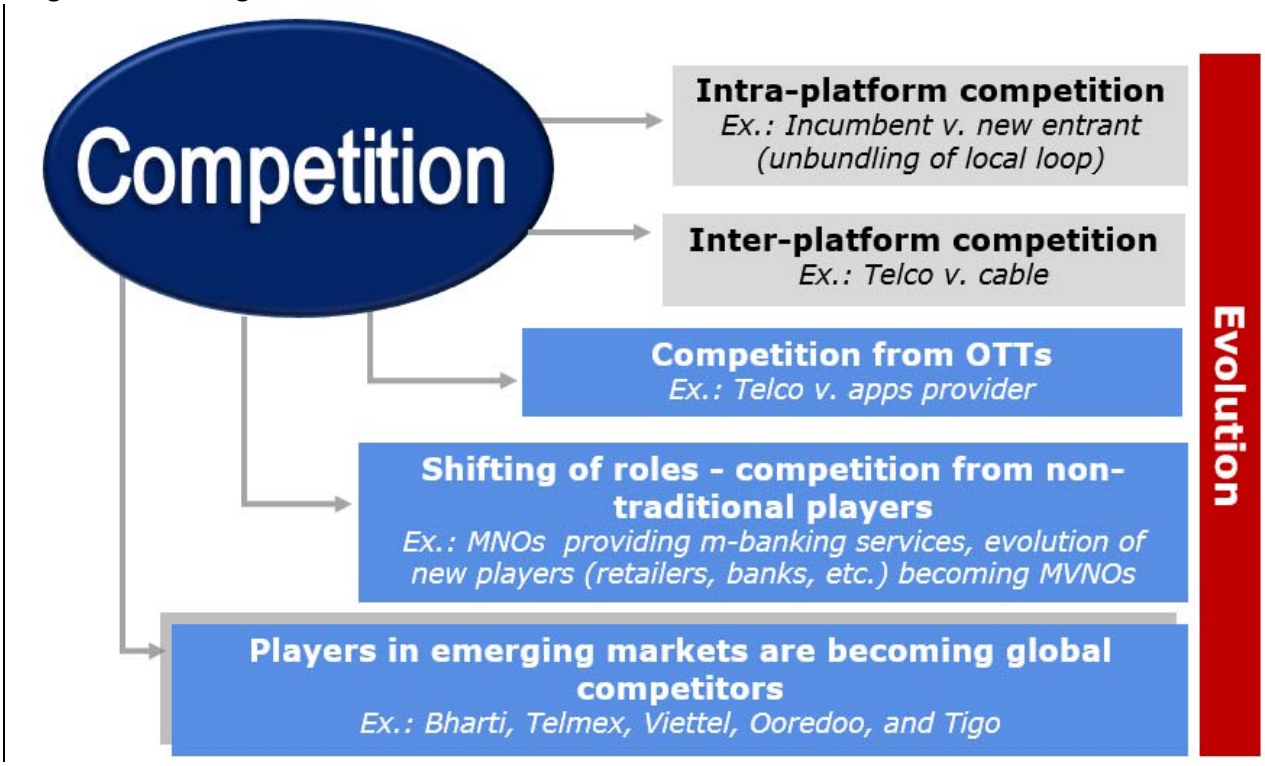
IP-enabled broadband networks allow ubiquitous access to all types of content. Users expect to be able to access any service and application from any device and from any location—whether high-quality voice and video telephony; business projects and documents; live, streaming and downloaded video (whether a two-minute YouTube video, television programming or a feature length film); music and games; email, text messaging and social media; and a myriad of mobile applications. The introduction of cloud-based services increases the importance of access as users can begin a project or program on one device and finish it on another in a different location. From the consumer's perspective, this seamless and ubiquitous access highlights the importance of content while de-emphasizing the delivery mechanisms. Users are not necessarily concerned about the underlying network technologies used to deliver their content, as long as their networks are secure and fast.

Although a converged broadband environment has undoubtedly expanded the user's experience, the provider side has become more complex. For over a decade now, traditional telecommunications service providers that were previously in different markets now compete with one another. For example, bundled "triple play" packages mean that traditional telephony operators have expanded into pay TV services by offering Internet protocol television (IPTV), while cable TV operators have expanded into telephony services by offering voice over Internet protocol (VoIP) services, and both offer high-speed Internet access. Similarly "quadruple play" packages (fixed line telephony, pay TV and Internet, plus mobile services) offered by a single company add even greater complexity to the field of competition.

In addition to the changes taking place amongst the traditional telecommunications companies, those same companies are now facing competition from new providers in downstream markets. In the past, traditional companies provided services that were intimately tied to their infrastructure—broadcasters supplied radio and television programming; telephone networks provided voice communications (and some data) and cable television provided video programming. In today's world, with broadband rapidly becoming the norm, all voice, data and video services can be provided over a single converged network. As a result, content and applications have been separated from the underlying transmission. More importantly, this has led to a boom in new content and application providers that do not own the access

networks, but that compete with operators' traditional services, such as OTT voice (Skype) and video (Netflix) services. Network operators are also now expanding into content markets in order to generate new sources of revenue and try to prevent from becoming mere conduits (or "dumb pipes") through which other firms' content passes. Figure 3 shows how the competitive landscape is changing and becoming more international in scope.

Figure 3: Challenges to Traditional Service Providers



Source: TMG

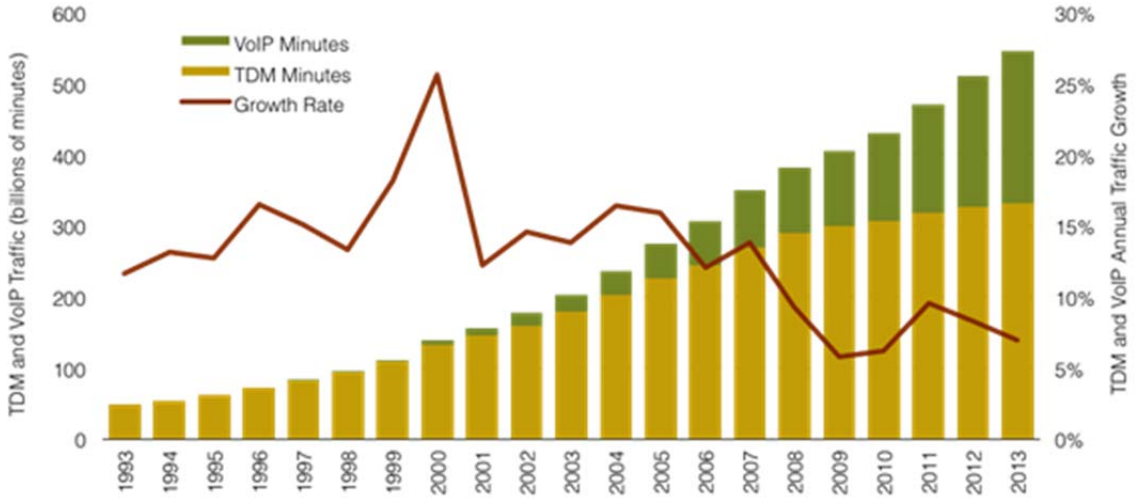
One example of this trend is VoIP. Rising from a simple program to provide voice communications between personal computers using a data connection, VoIP has become a multi-billion dollar business, with Skype alone earning nearly USD 2 billion in 2013 alone.[7] More importantly, VoIP has been taking an increasing share of global voice traffic (see Figure 4). TeleGeography estimates that Skype's on-net international (Skype-to-Skype) traffic grew 36 per cent in 2013, to 214 billion minutes.[8] While the volume of international telephone traffic still remains far larger than international Skype traffic, Skype's traffic is growing much more rapidly. Skype added approximately 54 billion minutes of international traffic in 2013, 50 per cent more than the combined volume growth of every carrier in the world,

[7] Dina Bass, "Microsoft Skype Unit Approaching $2 Billion in Annual Sales," Bloomberg News, 19 February 2013, http://www.bloomberg.com/news/2013-02-19/microsoft-s-skype-unit-approaching-2-billion-in-annual-revenue.html.

[8] Telegeography Report on International Voice, (January 2014) http://www.telegeography.com/page_attachments/products/website/research-services/telegeography-report-database/0004/6341/TG_executive_summary.pdf

combined.[9] Currently, 39 per cent of international calls are completed via Skype. Figure 4 shows how VoIP growth is continuing to accelerate, even as traditional voice calling is slowing.

Figure 4: **International Call Volumes and Growth Rates, 1993-2013**



Source: Telegeography Report, 2013.

Clearly the success of VoIP has undercut traditional models of voice telephony carriage. How have operators responded? In many cases, operators initially resisted allowing VoIP applications as they correctly perceived it as a threat to their traditional revenue stream. This resistance was often then reflected in laws and regulations that limited VoIP, as governments sought to protect their monopolies (especially if state-owned) and their own tax revenues. Many of these restrictions remain in place today. Over time, however, VoIP has slowly entered the mainstream, particularly in the mobile segment of the market, as carriers themselves began to offer their own interconnected VoIP services to compete with VoIP applications like Skype or Viber. Although VoIP is allowed in a large majority of countries, it remains illegal in nearly 30 countries.[10]

In the video services market, a broad range of services has sprung up, ranging from user-generated content sites like YouTube to sites offering high-definition movies and television shows, like Netflix, Lovefilm in the United Kingdom (now Amazon Prime), and Hulu. The rise of Netflix has been particularly strong. Between 1999, when it began its video streaming operations, and April 2014, Netflix has acquired almost 50 million global subscribers, and a 32.3 per cent video streaming market share in the United States.[11] Netflix currently operates in over 40 countries[12].

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[9] Telegeography Report and Database on International Voice, (January 2014) http://www.telegeography.com/research-services/telegeography-report-database/

[10] ITU, "World Telecommunication/ICT indicators and World Telecommunication/ICT Regulatory databases," 2013, www.itu.int/icteye.

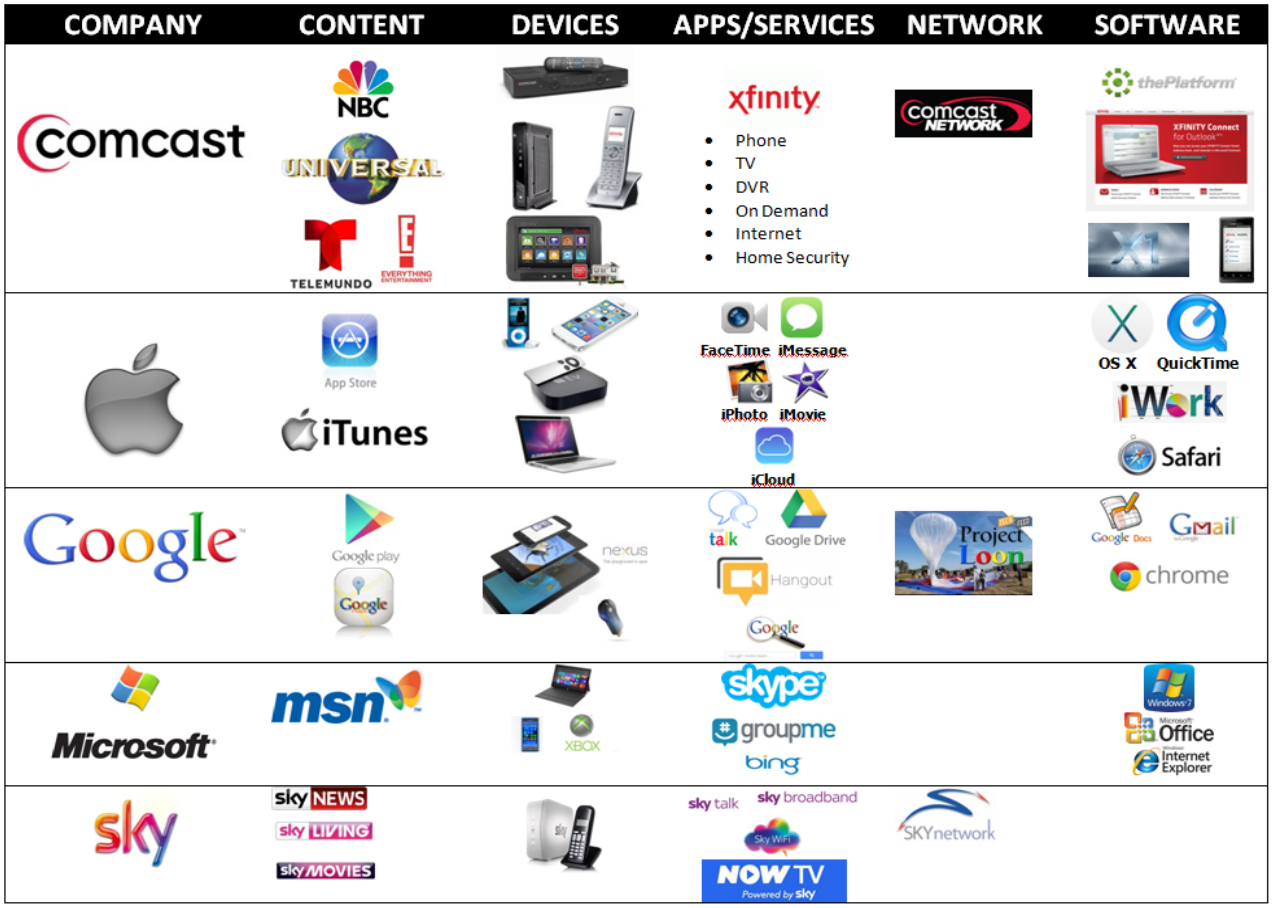
[11] Reuters, "Netflix price hikes seen boosting global expansion," April 22, 2014, available at: http://www.reuters.com/article/2014/04/22/us-netflix-results-idUSBREA3K14N20140422

[12] Netflix to launch in six more European countries this year, May 21, 2014, available at: http://www.reuters.com/article/2014/05/21/us-netflix-europe-idUSBREA4K03D20140521

Existing video content programmers or developers have responded, in many cases, by starting their own video streaming services. Hulu, for example, is owned by Comcast, Disney, and Fox, and makes content available in the United States and Japan from NBC, Fox, ABC, TBS, WWE, among others. In the United Kingdom, NowTV was launched by Sky in July 2012 and now offers a stand-alone streaming box or applications that enable content to be viewed on an iPad, iPhone, Android devices, personal computers, Roku, Smart TVs from LG, PS3, and Xbox 360. The rapid proliferation of video services shows that companies see great potential in video services going forward, and competition between traditional, OTT and hybrid providers is likely to be intense.

More broadly, the last few years have also seen a rise in acquisitions and consolidation as companies expand their business lines to include network, hardware, software, services, online content (e.g., music, books, movies, etc.) apps, retail stores, etc. to create a complete ecosystem. Companies have generally done this through a hybrid approach of internally expanding their business and/or by acquiring other companies that can provide them with additional businesses and/or assets to enhance their participation in the market. Google for example has the Google Play Store, the Android operating system, Project Loon, fiber network, and Google Hangout, among others. Apple has created a similar ecosystem with devices (iPads, iPhones, computers) and software (IOS), iTunes, and FaceTime. Others have acquired their new business via acquisitions such as Microsoft's purchase of Skype and Facebook's purchase of WhatsApp. Likewise, many of the new players in the market are prompting the traditional players to rethink their business strategies, and become more innovative in their plans, products, and services. As a result, more traditional players are pursuing acquisitions to horizontally or vertically integrate their business, such as Comcast's acquisition of NBC Universal and its proposed acquisition of Time Warner, as well as AT&T's recent announcement that it is purchasing DirecTV (see Figure 5).

Figure 5: Companies Developing Technology Ecosystem - "Covering All the Bases"



Source: TMG

As companies address the current landscape where data and communications flows are experiencing tremendous growth, they are also expanding their businesses internationally. Netflix started out as a domestic business in the United States; by 2013 (only three years after starting its international expansion), almost one quarter of its streaming customers resided outside of the United States, and the company just announced plans to expand to six European countries by the end of 2014. Approximately 66 per cent of Apple's revenues in the second quarter of 2014 and 40 per cent of Amazon's revenues in the first quarter of 2014 came from sales outside the United States.[13] In addition, companies that were local or regional players are expanding internationally as well. The telecommunications operations of Telmex, based in Mexico, were limited to the Americas, but has recently begun to make acquisitions in Europe. Similarly, Bharti of India purchased Zain's operations in Africa and now operates in eight countries in the region. Viettel of Vietnam has expanded its operations into Africa and the Americas. H3G, a new entrant in Europe, has acquired various companies in Austria and Ireland.

[13] Apple, "Apple Reports Second Quarter Results," Press Release, 23 April 2014, https://www.apple.com/pr/library/2014/04/23Apple-Reports-Second-Quarter-Results.html; Steve Lohr, "Amazon's Revenue Grew 23 Percent in First Quarter, Nearing $20 Billion," 24 April 2014, http://www.nytimes.com/2014/04/25/technology/amazon-quarterly-earnings.html.

3.1.3 Content delivery

As the Internet has continued to evolve, the delivery of content to end users has grown more complex. The key driver behind these changes in recent years has been the growth of video traffic and, most recently, the increasing shift from recorded or on-demand video to live streaming. For example, video streaming will account for an estimated 69 per cent of all consumers Internet traffic by 2017, up from 57 per cent in 2012.[14] The direct impact is a change in Internet traffic flows leading to an asymmetric in-bound to out-bound traffic mix as a consequence of increased traffic from content delivery networks (CDNs) to service provider networks that connect end users.

To accommodate for exponential traffic growth and consumer demand, new arrangements to exchange traffic and payments and increased instances of vertical integration have emerged within the Internet supply-chain. This includes, in particular, the growth and evolution of CDNs, the deployment of national Internet Exchange Point (IXPs) and the adoption of paid-peering arrangements for exchange of traffic.

Box 2: The increased relevance of CDNs for Internet traffic exchange

CDNs comprise a network of servers deployed across multiple networks in several data centers that enable fast and high-quality delivery of content to end users. Caching content close to the edge of the network via a CDN is especially attractive to OTT providers that offer video streaming as their content is latency-sensitive and uses large amounts of bandwidth. CDNs have increasingly become key players within the distribution of Internet traffic. It is estimated that 65 per cent of all Internet video traffic will cross CDNs in 2017, up from 53 per cent in 2012.[15]

There is already a significant number of CDNs around the world.[16] Originally, pure-play CDNs, like Akamai and Limelight, invested in caching technologies to host content closer to the end users. As video began to be embedded in web sites, CDNs began to distribute pre-recorded or on-demand content and subsequently to stream live content. However, other actors within the Internet ecosystem have been vertically integrating into the CDN market. This includes Internet backbone providers, such as Level 3, content providers (CPs), such as Netflix or Google, and Internet service providers (ISPs), like Telefonica (Spain), Comcast (U.S.), Korea Telecom, Telecom Italia, and SFR (France), to name a few.

The goal of this strategy is to essentially cut out the middle man –the pure-play CDN. A pure-play CDN operator gets paid by the CP for delivering its content to the CP's audience of end users. The CDN in turn must pay ISPs, carriers, and network operators for hosting its servers in their data centers. By vertically integrating into the CDN market, CPs are able to save the costs of paying for transit traffic over Internet backbones.

The latest step in this continual evolution is the push to create CDN federations mainly to expand the geographic footprint of its individual members. These can be characterized as a multi-tier integration

[14] *See* Cisco Visual Networking Index: Forecast and Methodology, 2012–2017, *available at* http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.pdf.

[15] *Id*.

[16] A list of selected active CDNs can be found at www.cdn-advisor.com.

between CDNs, which involve agreements similar to peering at an IP-layer, allowing interconnection, and integration between CDNs and the ability to exchange traffic between them and deliver service to an end user. While still incipient, CDN federations initially covered operator-owned CDNs only, but pilots for incorporating pure-play CDNs into federations are ongoing.[17]

An issue for many countries, particularly where there is low Internet penetration, is a lack of IXPs. This results in bottlenecks in which small ISPs do not exchange enough traffic to engage in settlement-free peering and therefore must either aggregate their traffic with other ISPs or pay for interconnection (i.e., paid peering). Additionally, countries without their own IXPs must transit all Internet traffic through another country (called tromboning), which affords large backbone providers more bargaining power and reduces quality of service since traffic must travel longer distances before reaching the end user.

The early Internet ecosystem—before the rise of IXPs—was strongly hierarchical with backbone providers at the top and able to dictate terms. IXPs, however, have flattened the hierarchy by enabling ISPs to peer directly to one another through secondary peering arrangements. IXPs themselves have developed due to increases in Internet demand and new players, such as CDNs, which have created a market to deliver content closer to the edge of the network.

As IP transit is substituted for settlement-free peering at the local level, these developments have had a significant impact on increased traffic flows as well as cost savings relating to the exchange of Internet traffic in many developing countries. For instance, a Google cache deployed in Kenya boosted traffic over the Kenyan IXP (KIXP) from 100-150 Mbit/s to around 1 000 Mbit/s. By peering locally, the Kenyan ISPs did not have to buy transit for this traffic, which then ranged from USD 150 to USD 600 per Mbit/s/month.[18]

Section 4.6 addresses Internet interconnection issues in more detail.

3.2 Why are these changes important?

The importance of such changes is that they are also reshaping the regulatory and competitive landscape. Legacy regulations that applied just to monopoly telephony providers make little sense in an environment where companies can provide a wider range of services than before and compete with each other. So, for example, should a traditional telephone company that now provides IPTV services still be regulated as a telephony provider, a cable company, a broadcaster, or something new entirely? Similarly, new entrants to this converged ICT market often have no physical networks and operate with business models that are nothing like traditional telecommunications companies. What regulations should apply to them? In this situation, regulators face a complex task to ensure that all competitors are treated fairly and competition can flourish, while also seeking to ensure that market-led rapid innovation continues and government regulations do not provide disincentives for new entrants or entrepreneurs.

[17] *See* Francois Le Faucheur, CDN Federation: Lessons from Phase 3 of the CDN Federation Pilot Cisco, Content Delivery Summit, NYC, May 20, 2013, available at http://conferences.infotoday.com/documents/172/2013CDNSummit-B102C.pdf

[18] OECD Communications Outlook 2013, p. 143.

The consequences of these changes are largely positive, but also quite disruptive. For example, this active marketplace with new business models, new players, and new services is creating an unprecedented amount of choice for consumers, who can now use services from a variety of providers. For policymakers and regulators, however, the result of all these changes is an ICT sector that is evolving rapidly and becoming increasingly complex. This, in turn, means that competition regulation must evolve to reflect the new players and new ways of providing services; old regulatory constructs and competition policies may no longer make sense or serve the purposes for which they were originally developed.

4 REGULATORY RESPONSES TO CHANGING COMPETITIVE CONDITIONS

As policymakers and regulators confront this rapidly changing environment, a range of issues must be addressed to ensure that competition can continue to flourish in all the different segments of the ICT sector and throughout the broadband value chain. Although the benefits of competition are widely recognized, the dynamic nature of the industry itself poses several challenges to identifying whether and what types of regulation are needed in order to effectively promote competition. First, as the various markets continue to develop and mature, the regulatory framework must be flexible enough to accommodate the changes, and specific regulatory obligations and requirements must be updated to reflect new market conditions. Incumbents, for example, may lose their large market shares to new entrants, so there is no longer a clear dominant operator. This, in turn, can lead to removal or easing of *ex ante* regulation in favor of *ex post* competition rules.

Second, technological and service convergence has blurred the lines between traditional products and services, making it more challenging for regulators to delineate between relevant markets. For example, in many countries regulators are debating whether fixed line broadband and mobile broadband are distinct markets or whether there is sufficient fixed line to mobile demand-side substitution to conclude that a single broadband access market exists.

Third, as noted in Section 3, the emergence of new actors and business models in the broadband value chain, such as OTT (e.g., VoIP) applications, cloud computing and CDN providers, raises questions of how to apply existing competition rules in an objective, non-discriminatory way. In many jurisdictions, the services provided by these new players may not be included in market analyses and may not be subject to existing ICT regulation, despite the fact that they provide similar services. The challenge is how to support these new players and innovation—and the positive impacts they are having on consumer choice, services and prices—as well as facilitate the roll-out of new businesses that are driving big data and the Internet of Things.

Finally, the new markets and competitors arising in a converged broadband environment also create new opportunities for operators to cut costs and improve efficiencies wherever possible through horizontal and vertical integration, a trend that can negatively impact consumers' ability to realize the full benefits of a competitive marketplace and that may unfairly disadvantage their (new and old) competitors. In particular, policymakers and regulators are increasingly taking a closer look at vertical integration issues. In addition, market shifts in Internet interconnection are also highlighting potential new issues.

The following sections discuss some of the key ways in which policymakers and regulators seek to promote competition in the context of these complex challenges.

4.1 Licensing reforms

In the past, many countries did not have competitive telecommunications markets due to restrictions resulting in a single, monopoly operator. The simple solution that most countries have adopted is to liberalize their markets and open the provision of ICT services to multiple providers. Regulators have introduced various licensing-based measures to facilitate competition. These have included eliminating exclusivity and allowing for any number of entrants who satisfy the licensing criteria (with the exclusion of scarce resources, such as spectrum). In addition, the process to obtain licenses has become much more streamlined in terms of the application process (i.e., the information to be provided and the requirements that must be met) as well as the timeframe to obtain a license.

Today, many jurisdictions are looking into the prospect of fostering competition and innovation by allowing the use of new services through liberalized licensing measures, or by not requiring any type of license. For example, unlicensed[19] (also called license-exempt) spectrum rules have enabled the boom in Wi-Fi, Bluetooth and other devices that are now integrated into the broadband ecosystem.

One example of how licensing can influence competition is seen in the varying policy and regulatory responses to VoIP. Competition in the voice telephony market has changed dramatically over the years due to the introduction of VoIP. Policymakers and regulators, however, have sometimes struggled with how to oversee the new entrant/technology; ranging from outright bans to policies that subject VoIP providers to the same regulatory requirements imposed on traditional telephony providers. Over 80 per cent of countries responding to the 2013 ITU Regulatory Survey indicated that VoIP is legal, a percentage that has remained largely unchanged for the last several years. However, a minority of countries either prohibit or strictly regulate the provision and use of peer-to-peer (P2P) VoIP and other OTT applications—often to protect incumbent revenues. This is particularly the case with P2P Skype, which has substantially cut into profits of incumbent's operators.[20]

Some countries have officially banned P2P Skype, Viber (an encrypted app that allows callers to make calls and send texts to other Viber users) and other OTT applications on the basis, at least in part, that they deprive licensed operators of their voice and text message revenues.[21] Most countries that limit P2P Skype and other OTT applications, however, do so by classifying such applications as telecommunications services subject to onerous licensing obligations or limiting the number of licenses available to just the incumbents. In these scenarios, only licensed operators (and typically just the incumbents) are permitted to offer any type of telecommunications service, including P2P Skype, which means that Skype and other OTT applications are available only if the operators permit them. This enables the incumbents to decide whether or not to allow competition from OTT applications and inhibits consumer choice since they are unable to access certain apps and services that are available in other countries. Consumer pressure, however, can encourage operators to unblock apps. For example,

[19] For which radiocommunication devices are exempted from individual licensing, as they have been already authorised in a general manner to operate under a specific regulatory framework (also named *Generic Use Licensing*, or similar; i.e. Wi-Fi devices).

[20] Global flows in a digital age: How trade, finance, people, and data connect the world economy, McKinsey Global Institute, April 2014.

[21] MTIT, "Ministry News," June 27, 2012, http://www.mtit.gov.ps/index.php?option=com_content&view=article&id=784%3A2012-06-27-09-32-07&catid=1%3A2011-03-30-09-48-14&Itemid=25.

Escalate and du In the UAE blocked Skype's website and use of the app to make P2P VoIP calls and calls that connected to the public switched telephone network (PSTN) until April 2013 when both operators lifted the ban and enabled customers to use the application.[22] Although neither operator expressly stated its reasons for unblocking the app, du implied that it was due to customer pressure.[23]

4.2 Access obligations

Building communications networks requires significant sunk cost, especially if nationwide coverage is required as part of the license terms. In an attempt to facilitate competition for new and smaller players, certain countries have imposed access obligations on dominant or SMP operators that require them to allow their competitors to use their network elements at cost-based rates and on non-discriminatory terms. While the effects of these policies are controversial, access obligations are generally intended to facilitate competition by removing high barriers to entry associated with new entrants building out their own network infrastructure. Recently, in a new approach, governments themselves are creating shared, open access networks that provide wholesale services to retail providers. Such networks are being created in response to the same cost/efficiency issues addressed above, as well as a desire to speed up the deployment of broadband services.

4.2.1 Opening wireline network access

Wholesale obligations may require incumbents to lease out just passive infrastructure, such as masts, ducts or poles, to smaller competitors or require full unbundling of the local loop for telephony and bitstream access for broadband services.[24] At the same time, because *ex ante* wholesale access obligations involve a greater degree of regulatory intervention than interconnection obligations and regulated termination rates, they potentially create even greater market distortions.[25] As such, mandated unbundling obligations, if adopted, should be carefully tailored to each country's unique situation. In addition, regulators should review wholesale access regulations on a regular basis and eliminate any *ex ante* obligations if they are no longer necessary to facilitate effective competition. According to the ITU's annual telecommunication regulatory survey in 2013, 50 per cent of the 181 countries responding to the survey reported that they require full unbundling of copper local loops and 36 per cent reported wholesale bitstream access obligations are in place.[26]

Many regulators view these obligations as a means to enhance competition, given that fixed line broadband, in particular, requires substantial investments, which may be economically burdensome or inefficient for new entrants to replicate, especially in rural areas. While the expectation is that regular market reviews will demonstrate at some point that competition is sufficient to no longer warrant mandated access obligations, nearly all countries that have imposed LLU or bitstream access obligations have opted to maintain them, at least for some markets. As outlined in Box 4, Canada is one of the few countries currently revisiting its wholesale access regulations and considering the removal of certain obligations.

[25] ITU, "Telecommunications Regulation Handbook: Tenth Anniversary Edition," 2011, http://www.itu.int/dms_pub/itu-d/opb/reg/D-REG-TRH.01-2011-PDF-E.pdf.

[26] International Telecommunication Union, "World Telecommunication/ICT indicators database," www.itu.int/icteye.

Box 3. Canada's ongoing reviews of mandatory unbundling for broadband access services

In *Telecom Decision CRTC 2008-17*, the Canadian Radio-Television and Telecommunications Commission (CRTC) articulated new rules for the regulation and pricing of wholesale telecommunications services provided by incumbent carriers. Under these rules, large operators must provide unbundling of broadband network infrastructure as well as traditional network elements.

In 2010, the CRTC reiterated that large incumbent local exchange carriers (ILECs) and cable companies must make wholesale broadband available to competitors at speeds matching their own service offerings to facilitate competition in the retail Internet services market. However, in seeking to ensure that large operators would be incentivized to continue investing in network build-out and offering innovative services, the CRTC permitted such operators to charge competitors 10 per cent more than for unbundling of copper loops. In October 2013, the CRTC initiated a consultation process to once again review its rules relating to whether mandated wholesale unbundling remains appropriate, with particular focus on broadband. The CRTC noted that the broadband market had changed significantly over the last several years and the current ongoing proceeding is intended to provide an overall view of the wholesale broadband market. More specifically, the CRTC stated that it is considering whether changes should be made to relevant product and geographic markets, and whether new wholesale services should be included under mandatory unbundling rules and/or whether it should forebear on such obligations for any existing services. The consultation closed in December, and the CRTC has announced plans to hold a public hearing to further discuss the matter on October 27, 2014.

Sources: http://www.crtc.gc.ca/eng/archive/2008/dt2008-17.htm; http://crtc.gc.ca/eng/archive/2013/2013-551.htm; http://crtc.gc.ca/eng/archive/2010/2010-632.htm.

Other countries are forging ahead with unbundling and other *ex ante* obligations as part of a long-term regulatory strategy. For example, Brazil recently established a National Wholesale Trading System, which is a virtual platform for trading regulated wholesale products between operators.

Box 4: Brazil's National Wholesale Trading System

The Brazilian National Wholesale Trading System (*Sistema Nacional de Ofertas ao Atacado - SNOA*) is a virtual platform for trading of wholesale products between telecommunications operators.

SNOA is expected to be "a one stop shop" for the wholesale telecommunications market in Brazil, as it will compile all information necessary for a buyer when acquiring wholesale telecommunications products, such as towers, switching centers; Internet Exchange Points (IXP); and points of interconnection, among others. The virtual platform will also serve as a management system because it will provide performance indicators by each provider with significant market power (SMP), enabling Anatel to track the traffic transactions and requests, helping the regulator to assure that the market will operate in a fair and transparent competitive fashion. Ultimately, SNOA will provide transparency regarding the treatment of wholesale transactions, reducing asymmetric information and transaction costs, and above all, reducing disputes among all players. SNOA's system is managed by a Wholesale Board comprised of SMP and non-SMP operators. It is funded by the SMP operators and has a budget of USD 10 million for five years.

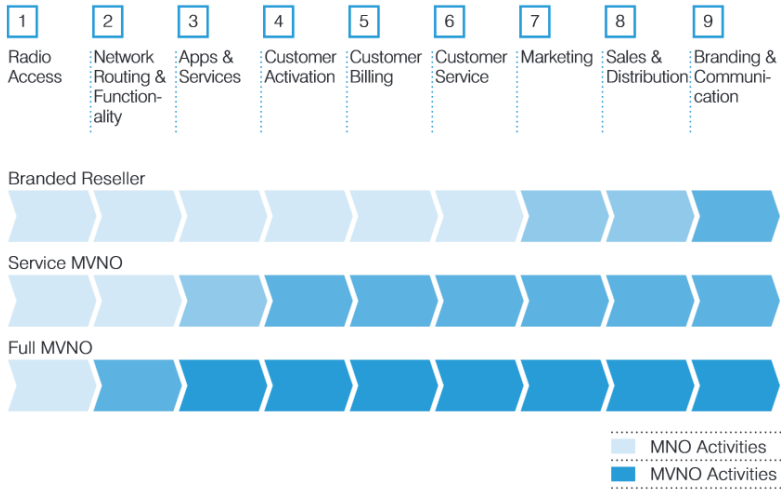
Sources: See Silva, Abraão, "The Brazilian National Wholesale Trading System (SNOA)," Anatel Presentation, Mar. 2014, Costa Rica, available at http://www.itu.int/en/ITU-D/Regulatory Market/Documents/CostaRica/Presentations/Session%207_Abraao_Anatel%20%282%29.pdf

4.2.2 Mobile Virtual Network Operators

A similar approach to opening access to new market entrants has also been instituted by many regulators in the wireless market. Beginning in the late 1990s, mobile virtual network operators (MVNOs) began to enter the mobile market in countries around the world. MVNOs offer mobile services to customers by reselling wholesale capacity purchased from Mobile Network Operators (MNOs) that own infrastructure. In this way, MVNOs avoid the costs of obtaining, owning and operating their own facilities-based mobile networks, and instead focus on providing services and marketing those services. MVNOs pay the host MNO for using its infrastructure to facilitate coverage to their customers, or in some cases are wholly owned subsidiaries of MNOs.

The entry of MVNOs into a market was seen by policymakers and regulators as a means to enhance competition with the established MNOs, providing subscribers with more – and hopefully more innovative – options when selecting mobile carriers. There have been a wide range of MVNO strategies, informed by a combination of regulation, MVNO investment, and target markets. Depending on the applicable regulations and the agreements negotiated with MNOs, MVNOs can determine which elements of service provision they will control directly as opposed to those that will be the responsibility of the MNO, as illustrated in Figure 7.

Figure 6: MVNO/MNO activity split



Source: Booz & Co.

MVNOs often target specific markets in an effort to succeed by catering to a niche that is perceived as underserved by existing service providers or, in some cases, to leverage brand affinity. For example, MVNOs targeting ethnic groups remain an attractive strategy for investors, though such services have enjoyed varying levels of success. Movida, a U.S. MVNO, launched in 2005 targeting the Hispanic market ceased operations in 2008, while KPN-owned Ay Yildiz, which targets the Turkish community in markets including Belgium, Germany, and the Netherlands, still operates in Germany while having ceased operations in Belgium and the Netherlands. Tesco Mobile, an MVNO established by UK grocer/retailer Tesco in the United Kingdom in 2003 has enjoyed success and expanded to four additional European markets. Other niches targeted by MVNOs have included the youth market and discount/low-cost services, as well as a first wave of MVNOs supporting M2M services.

Although MVNOs indisputably changed the competitive landscape simply by virtue of the entrance of new services and brands into the market, their effect on prices and service adoption have been unclear, as there has been relatively little in-depth analysis on the subject. Two economic analyses found that the entry of an MVNO into a market did not, in and of itself, have a significant impact on competition, and that MNO incentives to court MVNOs would depend on the likelihood of such MVNOs competing with the host MNO, as well as the potential for revenue generation.[27] These economic analyses were based on pure economic models, but noted that regulatory intervention could be employed to make market entry conditions for MVNOs more favorable. One of the reasons cited for the failure of MVNOs was over-segmentation of the market, with operators focusing too narrowly on a particular niche and being unable to build a profitable business without a broader customer base.

In recent years, there has been something of a resurgence in MVNO interest among service providers focused on new niches, as well as new attempts to cater to previously targeted niches. While there is no single shift that is responsible for such a development, we can broadly point to changing user needs and an overall increase in the availability of mobile data connectivity as key enabling changes in the market. In such cases, the market has identified a gap that can be filled – profitably, it is presumed – by MVNOs. In another case, European regulators focus on reducing roaming fees has created an opening for MVNO services.

In particular, the growing interest in M2M services and the "Internet of Things" (IoT), combined with expanding 3G and 4G data service offerings from MNOs have spurred new interest in MVNOs offering data connectivity for such services. For example, despite the existence of an established group of M2M-focused MVNOs – as well as increasing interest in M2M services by MNOs themselves – a new pan-European MVNO, CoSwitched, has stated its belief that the European market needs a simple, affordable, regional M2M MVNO.[28]

In Europe, recent changes to regulations setting upper limits on wholesale and retail data roaming services have the potential to drive the creation of MVNOs focused on providing data services to customers roaming outside their home markets. The European regulations set enough of a margin between the maximum wholesale and retail data rates that there is a legitimate opportunity for new entrants to provide such roaming services and generate a profit. Roaming-only MVNOs will be able to enter the European market in July 2014, and MNOs and MVNOs will be required to provide their subscribers with the capacity to be served by alternative roaming providers when they travel outside their home market.

Other new permutations of the MVNO model continue to arise. In Kenya, the regulator awarded three MVNO licenses in April 2014, two of which went to firms with a clear interest in mobile payments, which are a key driver of Kenya's mobile market. One analyst suggested that the entry of MVNOs in the Kenyan market allows for mutually beneficial arrangement in which the MNO derives revenue from excess

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[27] Philip Kalmus and Lars Wiethus, "On the Competitive Effects of Mobile Virtual Network Operators (Preliminary)," (September 2006), http://www.webmeets.com/files/papers/EARIE/2007/401/Kalmus_Wiethaus_2006.pdf and Ralf Dewenter and Justus Haucap, "Incentives to license mobile virtual network operators (MVNOs)," (2006), http://userpage.fu-berlin.de/~jmueller/its/conf/amsterdam06/downloads/papers/dewenter_haucap_workingpaper.pdf.

[28] European Communications, "Start-up IoT MVNO aims to disrupt M2M market with value connectivity offer," (March 20, 2014), http://www.eurocomms.com/industry-news/49-online-press/9708-start-up-iot-mvno-aims-to-disrupt-m2m-market-with-value-connectivity-offer.

network capacity and the MVNO obtains the network infrastructure it needs to launch a profitable service.[29] In April 2014, messaging provider WhatsApp began offering a SIM card through German operator E-plus, providing unlimited access to the WhatsApp service without counting against the subscriber's data allowance. Facebook-owned WhatsApp refers to the partnership with E-Plus as an MVNO, although the SIM is marketed with the names of both the messaging provider and the carrier.[30] In May 2014, an analyst suggested that music streaming firm Pandora consider launching an MVNO in the United States in a bid to improve its revenue stream, which is currently driven primarily by advertising.[31]

4.2.3 Wholesale, open access models

In their strategies to deploy widespread, affordable access to broadband as quickly as possible, some countries are moving beyond implementing unbundling/bitstream access obligations at the wholesale level by creating a wholesale broadband access network. These wholesale, open access models seek to ensure deployment of the domestic backbone and metropolitan connections and promote retail competition at the local connection level.

The plan to establish a partially or fully state-owned, wholesale-only, fiber-based broadband network operator that sells capacity to an array of retailers was initially adopted in Australia in 2011 and has gained some traction in other countries, particularly in Brazil, Kenya, Oman, and South Africa.[32] Singapore and Peru have adopted similar models, but instead of a state-owned wholesale provider, the entities deploying the broadband backbone are private operators, with financing coming from a mix of private and public funds.[33]

The basic premise of these wholesale open access models is that a governmental entity builds out broadband infrastructure nationwide, then leases access to retailers on a transparent, non-discriminatory, and wholesale-only basis. In turn, retailers sell high-speed Internet access to end users. The idea behind such an approach is that the state removes bottlenecks, while ensuring that retailers can access facilities at wholesale rates so they may deliver broadband services to consumers, businesses, and institutions.

More recently, there are also examples of the open access model being pursued for mobile services. For example, Mexico and Kenya are both pursuing the open access model for the 700 MHz band. The regulator in Mexico, IFT, is examining a number of different options for the creation of an independent

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[29] HumanIPO, "Kenyan MVNOs boost competition, spectrum efficiency – analyst," (May 20, 2014), http://www.humanipo.com/news/44147/kenyan-mvnos-boost-competition-spectrum-efficiency-analyst/.

[30] TechCrunch, "WhatsApp Becomes An MVNO, Sells €10 SIM In Germany With Free WhatsApp Use Included," (April 7, 2014), http://techcrunch.com/2014/04/07/whatsapp-launches-a-e10-sim-with-e-plus-in-germany-with-free-whatsapp-usage-included/.

[31] Generator Research, "Pandora should consider becoming a virtual mobile network operator," (May 21, 2014), http://www.generatorresearch.com/tekcarta/analysis-insight/pandora-should-consider-becoming-a-virtual-mobile-network-operator/?lid=01a259167aa210514a155837a.

[32] Australia Department of Communications, "National Broadband Network," http://www.communications.gov.au/broadband/national_broadband_network.

[33] Infocomm Development Authority, "Singapore's Next Generation Nationwide Broadband Network," 2010, http://www.ida.gov.sg/~/media/Files/Infocomm%20Landscape/Infrastructure/Wired/IDA_INFOKIT.pdf

operator that would use the 700 MHz band to provide wholesale broadband services in the country. The new operator could offer services using 700 MHz, as well as the dark fiber belonging to state-owned power company Comision Federal de Electricidad. In Kenya, the Ministry intends to roll-out a wireless broadband network through a public-private partnership (PPP) whereby the PPP company will offer services to service providers on a wholesale basis only and will not be permitted to offer services to end users.[34] Unlike with the Mexico model, Kenya has listed a number of spectrum bands that may be included under this PPP model.

Increasing competition and universal access are the drivers behind pursuing these models, both on the fixed line and mobile sides. The government authorities view this as a mechanism to increase coverage and quality of service, as well as to allow fair competition in the provision of services and provide affordable data services to consumers. However, there are potentially large drawbacks. First, these initiatives are subject to intense political pressure and governmental budgets, making it a challenge to implement plans and maintain financing over the years it takes to fully realize the plans. For example, a change in Australia's government last year prompted a significant scale-back of the country's NBN project. Rather than provide fiber-to-the-premises (FTTP) directly to 93 per cent of homes, schools and businesses, the government announced in November 2013 that FTTP would be provided only to about 25 per cent of buildings with the remaining getting fiber-to-the-node (FTTN) with last mile connectivity via DSL.[35] Additionally, these initiatives drive out private investment and can reintroduce the same issues with liberalization and privatization as addressed over the last few decades in the traditional telephony market. Finally, these models represent a relatively novel approach for broadband, with many complex aspects and only limited case studies from the ICT sector on which to rely.

4.3 Network and spectrum sharing: cooperation and competition in broadband

With the liberalization of former monopoly-based markets, significant issues have arisen over the need for new providers to build out their own physical networks. In the past, many countries, particularly those with dominant ex-monopoly providers, have turned to access obligations (see section 4.2) to make it easier for new players to enter a market by using the incumbents' existing network. Today, as they seek to extend networks to areas that are unserved or underserved, policymaker and regulators are considering regulatory approaches that allow, encourage, or even require competing companies to share the basic infrastructure that provides the services, rather than forcing them to compete on a facilities basis.

In urban areas, multiple networks may be easily supported because of the large subscriber base from which to generate revenue and recover upfront investments, but in low-density population areas, having multiple capital-intensive networks may not make economic sense, since the return on investment may not cover the cost of building and operating the network. As a result, network operators are adopting new network infrastructure and spectrum sharing models in order to share the substantial costs of network deployment and maintenance while meeting obligations to roll out broadband services. Many countries have prohibited such sharing arrangements in the past due to

[34] Consultation on Wireless Broadband Spectrum Policy Guidelines, Ministry of Information, Communications and Technology, Republic of Kenya, http://www.information.go.ke/wp-content/uploads/2014/03/DraftSpectructionPolicy.pdf

[35] Rodney Tucker, "he Rise and Fall of Australia's $44 Billion Broadband Project," IEEE, 26 November 2013, http://spectrum.ieee.org/telecom/internet/the-rise-and-fall-of-australias-44-billion-broadband-project.

concerns about anti-competitive behaviour, such as collusion, as well as believing that true competition required operators to build out their own infrastructure and engage in facilities-based competition.

With respect to the competitive aspects of infrastructure and spectrum sharing, discussed in more detail in Sections 4.3.1 and 4.3.2, regulators must consider whether the particular sharing being proposed would (or does) negatively impact competition in the relevant wholesale and retail markets.[36] According to a report by the Body of European Regulators of Electronic Communications (BEREC)/Radio Spectrum Policy Group (RSPG), considerations could include whether sharing agreements are unilateral, bilateral, or multilateral; the geographic scope of the agreement; the impact on the competitive situation in the relevant market(s); who retains control of radio planning; exclusivity clauses; and whether the independence of a network operator is prejudiced.

In general, potential sharing agreements must be considered in light of their compatibility with applicable competition or other relevant law. In Europe, for example, infrastructure sharing agreements are evaluated with an eye to their compatibility with the Treaty on the Functioning of the European Union, both related to concerns over the immediate effects on competition in upstream and downstream markets, as well as to the possibilities of collusion or exchange of confidential information.[37] In addition, reviews of sharing arrangements must also balance anti-competitive concerns with any positive impacts on competition, such as increased incentives for network deployment, enhanced competition in services or lower cost structures and prices.

4.3.1 Infrastructure sharing

There are many different forms of infrastructure sharing, with some types more likely to implicate competition issues than others. Passive infrastructure sharing, such as sharing of ducts, poles, masts, or towers, does not require operators to coordinate operations and is generally viewed as posing little threat to competition. Since active infrastructure sharing requires operators to more closely coordinate, there is greater opportunity for competition issues, such as collusion, to arise.

There are many benefits to infrastructure sharing as examined in the 2008 edition of ITU's Trends in Telecommunication Reform[38] and in the 2008 GSR best practice guidelines adopted by world community of regulators focusing on innovative infrastructure sharing and open access strategies[39]. A 2012 study by the GSM Association (GSMA) came to the same conclusions.[40] Existing operators in mature markets can use infrastructure sharing to reduce operational expense (OPEX) and increase capacity to under-served areas while existing operators in nascent markets can save on capital expenditures (CAPEX) and OPEX and more easily expand coverage to previously unserved areas by sharing infrastructure. The study also

[36] BEREC/RSPG, "Joint BEREC/RSPG Report on Infrastructure and spectrum sharing in mobile/wireless networks," 16 June 2011, p. 13, http://rspg-spectrum.eu/_documents/documents/meeting/rspg25/rspg11-374_final_joint_rspg_berec_report.pdf.

[37] BEREC/RSPG, "Joint BEREC/RSPG Report on Infrastructure and spectrum sharing in mobile/wireless networks," 16 June 2011, p. 14, http://rspg-spectrum.eu/_documents/documents/meeting/rspg25/rspg11-374_final_joint_rspg_berec_report.pdf.

[38] http://www.itu.int/pub/D-REG-TTR.10-2008

[39] https://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/PDF/GSRguidelines08_E.pdf

[40] GSMA, "Mobile Infrastructure Sharing," Public Policy Report, 2012, http://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf.

found that infrastructure sharing can promote competition by lowering barriers to entry for new entrants, especially regarding mobile networks where national roaming is in place for a limited fixed timeframe while the entrant deploys its own network.

Since the benefits of infrastructure sharing tend to outweigh potential threats to competition in rural or underserved areas, regulators generally approve—and even encourage—infrastructure sharing agreements. For example, 106 countries responding to the ITU's ICT Eye annual survey in 2013 reported that regulators require operators to engage in passive infrastructure sharing for fixed line and mobile networks, up from 62 countries in 2008.[41] Regulators have more recently begun permitting mobile operators to share both passive and active infrastructure. According to the ITU's ICT Eye data, in 2008 124 countries reported that they permitted mobile infrastructure sharing, including active sharing through MVNOs. By 2013, 151 countries stated that such sharing is permitted.[42]

In the mobile market, most active infrastructure sharing takes place at the access network level, which includes sharing passive infrastructure, and increasingly active elements.[43] MVNOs typically share the access network equipment and passive infrastructure. Sharing the core network is the most integrated type of sharing, which involves passive infrastructure, backhaul equipment and the core transmission ring, switching center, billing platform and value-added systems (VAS). Due to the need to coordinate closely, and the increased likelihood of collusion, sharing of the core network and spectrum resources requires the most regulatory scrutiny.

Although regulators have been more hesitant to allow or encourage any type of active infrastructure sharing for mobile networks, they are finding that the benefits gained from faster deployments and lower costs outweigh the risks of potential collusion or other anti-competitive harms. For example, the four main mobile operators in the United Kingdom—Three, Everything Everywhere (EE), O2 and Vodafone—have all entered into some type of network sharing agreement for 3G networks since 2007, including for passive and active elements. Ofcom noted in 2009 that active sharing, such as radio access network (RAN) sharing, may raise competition concerns for a number of reasons. Most notably, Ofcom expressed concern over potential collusion due to the information exchanges necessary to coordinate sharing and an overall reduction in the intensity of competition between the sharing operators.[44] However, in 2011, Ofcom recognized the value of RAN sharing, noting that it reviews all sharing agreements on a case-by-case basis under EU competition law.[45] The success of the agreements, through cost-savings to the operators and faster, more affordable delivery of services to end users, is demonstrated through the operators' continued use of sharing agreements. In February 2014, for example, EE and Three announced a new network sharing agreement for their LTE networks, with the

[41] ITU, "ICT Eye: Infrastructure Sharing," 2013, http://www.itu.int/net4/itu-d/icteye/Topics.aspx?TopicID=15.

[42] ITU, "ICT Eye: Infrastructure Sharing," 2013, http://www.itu.int/net4/itu-d/icteye/Topics.aspx?TopicID=15.

[43] GSMA, "Mobile Infrastructure Sharing," Public Policy Report, 2012, http://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf.

[44] Ofcom, "Mobile Evolution, Ofcom's mobile sector assessment," Statement, 17 December 2009, ¶ 3.15, http://stakeholders.ofcom.org.uk/binaries/consultations/msa/statement/MSA_statement.pdf.

[45] Ofcom, "Consultation on assessment of future mobile competition and proposals for the award of 800MHz and 2.6GHz spectrum and related issues, Annex 6: Competition Assessment," 7 October 2011, ¶ 5.45, http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/annexes/Annex_6.pdf.

operators investing a total of GBP 1 billion (~USD 1.7 billion).[46] In the near term, the operators plan to share just passive infrastructure, particularly masts and backhaul transmission costs, which does not require Ofcom's approval. However, there may be active sharing in the future, which would require Ofcom approval. In 2013, the operators considered active sharing of their LTE networks in the 800 MHz band, but decided to scrap the plan in favor of their own rural deployments.[47] As their LTE networks grow, they may seek to restart negotiations in order to cover remaining under-served areas and/or share operational costs.

Another factor that should be considered by authorities weighing infrastructure sharing agreements is the balance between short-term and long-term effects. For example, imposing regulatory mandates for shared access to an incumbent's assets and facilities may increase competition in the short term, but increased obligations on operators may also decrease incentives for network deployment, thus having a negative impact on competition in the longer term. Conversely, regulations forcing a company to build its own infrastructure across an entire country may improve facilities-based competition in the short term, but if the network is not economically sustainable, the company could be forced out of business, thus reducing competition in the longer term.

4.3.2 Spectrum sharing

The skyrocketing demand for spectrum in order to keep pace with new bandwidth-hungry broadband-enabled applications and services has spurred policymakers and operators to better utilize existing spectrum allocations, as well as reallocate additional spectrum to mobile broadband use. Spectrum scarcity has driven new ideas for efficiently using existing resources, including through spectrum sharing. According to the ITU, of the 77 countries that responded to the ICT-Eye annual survey in 2013, 64 per cent replied that spectrum sharing is permitted.[48]

Spectrum sharing takes active infrastructure sharing a step further by combining sharing at the access network layer with sharing of dedicated frequencies. It can be defined as the simultaneous usage of a specific radio frequency band in a specific geographical area by a number of independent entities, leveraged through mechanisms other than traditional multiple- and random-access techniques.[49] In general, this means that end users of any participating operator can use their operator's services across any spectrum used in the shared network. Spectrum sharing can also allow for the more efficient use of spectrum resources and possible exploitation of under-used spectrum.

There are multiple approaches to spectrum sharing, including approaches where operators could share RANs with dedicated frequencies, with physical sharing of the node (hardware) but with the software components managed separately. Or, where multiple operators hold licenses for the same spectrum

[46] Ken Weiland, "EE, 3 take passive route to 4G network-sharing," Mobile World Live,3 February 2014, http://www.mobileworldlive.com/ee-three-take-passive-route-4g-network-sharing.

[47] Graeme Neill, "EE ditches Three talks over 4G spectrum, Mobile Today UK," 14 June 2013, http://www.mobiletoday.co.uk/news/industry/25654/EE_ditches_Three_talks_over_4G_spectrum_share.aspx.

[48] ITU, ICT-Eye, http://www.itu.int/net4/itu-d/icteye/.

[49] BEREC/RSPG, "Joint BEREC/RSPG Report on Infrastructure and spectrum sharing in mobile/wireless networks," 16 June 2011, p. 14, http://rspg-spectrum.eu/_documents/documents/meeting/rspg25/rspg11-374_final_joint_rspg_berec_report.pdf.

bands, RAN sharing can take place within the shared spectrum band, though this is technically and operationally more complex.

However, because spectrum sharing requires cooperation between companies that otherwise compete, some regulators have been wary of such agreements. For example, India's Department of Telecommunications (DOT) did not permit spectrum sharing under its licensing conditions and the guidelines on infrastructure sharing issued in 2007 (which considered spectrum sharing as a type of active infrastructure) opted to prohibit spectrum sharing between competing mobile service providers.[50] The Telecommunications Regulatory Authority of India (TRAI) sought to reverse this policy in May 2010 by issuing a series of recommendations to the DOT proposing to permit spectrum sharing in India.[51] The DOT's draft spectrum sharing guidelines circulated in late 2013, for example, indicated that such sharing could only take place in circles (geographic licensing areas) where the two operators wishing to share spectrum already hold licenses.[52]

In contrast, Sweden's ICT regulator, the Post and Telecom Agency (PTS) and the Swedish Competition Authority (Konkurrensverket) have supported mobile sharing of both spectrum and infrastructure. Sweden's ICT law specifically permits the PTS to impose spectrum sharing conditions on operators, which the regulator implemented in the 3G auction in 2000.[53] In that case, spectrum sharing has been considered a success. In 2009, mobile operators Telenor and Tele2 created a joint venture, called Net4Mobility. Through Net4Mobility, the operators now share spectrum in the 800 MHz, 900 MHz, 1800 MHz, and 2600 MHz bands. The benefits of the joint venture appear so far to have outweighed competition concerns. In particular, after a 2009 review of Net4Mobility, Sweden's competition authority determined that it did not raise competitive concerns and that the joint venture would provide for faster and less costly deployment of 4G networks in the country.[54] The competition authority's conclusions have since been confirmed—through the use of shared networks and spectrum, Tele2 announced in 2013 that its multi-band 4G LTE mobile broadband network covered 99 per cent of population.[55]

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[50] Telecommunications Regulatory Authority of India, "Recommendations on Infrastructure Sharing," 11 April 2007, http://www.trai.gov.in/trai/upload/PressReleases/447/recom11apr07.pdf.

[51] Telecommunications Regulatory Authority of India, "Recommendations on Spectrum Management and Licensing Framework," 11 May 2010, http://www.trai.gov.in/WriteReadData/Recommendation/Documents/FINALRECOMENDATIONS.pdf; Telecommunications Regulatory Authority of India, "Recommendations on Telecommunications Infrastructure Policy," 12 April 2011, http://www.trai.gov.in/WriteReadData/Recommendation/Documents/Rec_Infrastructurel.pdf; Telecommunications Regulatory Authority of India, "Recommendations on Spectrum Management and Licensing Framework- Response of the Authority on DoT reference no. 20-281/2010-AS-I(VoL)(Pt.)," 10 October 2011, http://www.trai.gov.in/WriteReadData/Recommendation/Documents/Final2011.pdf.

[52] The Telegraph, "Spectrum sharing spoiler," 22 December 2014, http://www.telegraphindia.com/1131223/jsp/business/story_17710584.jsp.

[53] See Chapter 3, Section 11, paragraph 5 of Sweden's Electronic Communications Act.

[54] KKV, Dnr 364/2009, 9 August 2010, http://www.kkv.se/upload/Filer/Konkurrens/2010/Beslut/beslut_374_2009.pdf.

[55] TeleGeography, "Tele2 Sweden reaches 99% 4G coverage?," 19 March 2013, http://www.telegeography.com/products/commsupdate/articles/2013/03/19/tele2-sweden-reaches-99-4g-coverage/.

4.4 Potential competition concerns raised by vertical integration

As technological and service convergence continues and OTT providers compete with traditional players, particularly in video services, access to content may be an area of competitive concern on the supply-side of the broadband market. So far, regulation in this area has been fairly limited due to the large and ever-expanding number of content providers and the relatively low barriers to entry into the content market. But, as horizontal and vertical integration increases, it may be possible for dominant network operators vertically integrated with large content providers to engage in a refusal to deal or other anti-competitive behaviours to prevent OTT providers from accessing key content, such as television programming or important sporting events. These are part of the concerns being expressed in relation to the Comcast and Time Warner merger currently being reviewed by government authorities in the United States (see Box 5). Such issues have often been addressed in a merger review context with the parties agreeing to certain concessions in order to address or alleviate competition concerns raised by the government authorities.

Box 5: Proposed Comcast/Time Warner Merger

In February 2014, Comcast Corp. and Time Warner Cable (TWC) agreed to a merger in which Comcast, a global and media technology company that is the largest U.S. video and broadband provider, would purchase TWC, the second largest cable company in the country, in a transaction valued at USD 45 billion. The resulting entity would reportedly control 30 per cent of the U.S. cable television market (including 19 of the 20 largest markets), more than 40 per cent of the broadband access market, as well as a large portfolio of cable and broadcast television networks. In April 2014, Comcast announced a divestiture plan in conjunction with Charter Communications to transfer approximately 1.4 million of TWC's current subscribers to Charter, thereby reducing the combined Comcast/TWC's managed subscriber base below 30 per cent of the nation's total cable television subscribers. In past mergers, Comcast has kept its share of the cable market below 30 per cent in an effort to avoid regulatory opposition.

Opposition to the merger, which has come from civil society, competitors, and legislators, has centered on the significant market power that the new Comcast would have over pay television and broadband service. Critics of the transaction are wary of allowing one company to control nearly a third of cable television subscriptions and more than 40 per cent of residential broadband subscriptions, as well as a reduction in the overall number of market players. Some worry that Comcast would not face robust sufficient competition to prevent it from taking actions viewed as unfriendly to consumers, such as drastic speed or bandwidth caps on broadband service, or higher prices or limited programming choices among pay television services. Echoing concerns that were raised in the 2009 acquisition of content provider NBC Universal by Comcast, some critics also have expressed concerns that Comcast will discriminate against other operators offering subscription TV services, such as Verizon, AT&T, and DirecTV, by withholding or charging excessive prices for NBC Universal's programming content.

Sources: Comcast, Reuters, Time, Washington Post

4.5 Net Neutrality

The Internet generally operates on a "best effort" basis in which all traffic is treated equally, except where data traffic is managed to ensure that congestion is minimized and all traffic reaches its final destination as quickly as possible. Consumers and entrepreneurs, however, have long been concerned

that ISPs block traffic (or particular websites) or discriminate against particular types of traffic in an effort to protect their own services (e.g., a mobile provider blocking VoIP applications to ensure that voice traffic stays on its network). As a result, there have been calls for regulators to enact regulations that would prevent such anti-competitive behaviours.

4.5.1 What is net neutrality?

As outlined in the ITU's *Trends in Telecommunication Reform 2013*, net neutrality broadly refers to the principle that all Internet traffic should be treated equally.[56] Net neutrality regulation generally requires an operator, regardless of market power, to treat all Internet traffic equally and to allow users to access and use the Internet content of their choice. This principle requires operators to not discriminate against any particular type of traffic, but also requires them to deliver service on a "best efforts" basis. Other principles of net neutrality relate to operator disclosure and transparency in implementing data caps or how they use temporary traffic management practices to relieve network congestion or protect network security.

Canada and Chile were among the first countries in the world to enact broad net neutrality legislation, in 2009 and 2010, respectively. More recently, the issue has been heating up, especially in Europe, Latin America and increasingly in the Asia-Pacific region. (See Box 6 for an overview of net neutrality rules in Europe and the Americas.) Net neutrality can be a political issue because blocking certain types of content may be viewed as implicating rights relating to freedom of expression and access to information.

In the limited countries where a full set of net neutrality laws and regulations have been proposed or enacted, the following rules tend to apply:

- **No blocking or degrading traffic:** As part of the non-discrimination principle, net neutrality rules prohibit operators from blocking access to certain applications and services. Most rules have an exception for reasonable network management practices whereby operators may prioritize or slow down traffic temporarily during times of network congestion or for network security. However, some countries, such as Chile, prohibit operators from singling out any particular application to prioritize or slow down.

- **No paid prioritization:** Based on the idea that traffic should be treated in a non-discriminatory basis, net neutrality rules tend to prohibit paid prioritization, which allows operators to charge consumers for Internet connectivity and charge OTT providers to reach consumers. Start-up companies, consumer groups, and small businesses are concerned that this will create a two-tiered Internet. They fear that these "pay-for-priority arrangements" will only be able to be paid by the larger companies and smaller businesses will be discriminated against both technically and financially by Internet service providers.

- **Disclosure and transparency:** The least contentious of the net neutrality rules—and the most common—relate to disclosure and transparency. Such rules require operators to clearly state what their network management practices are and may also require identifying the actual speeds and service quality levels that subscribers can expect. A number of countries have

[56] ITU, "Trends in Telecommunication Reform 2013," April 2013, http://www.itu.int/pub/D-REG-TTR.14-2013.

adopted such regulations, rather than enacting more onerous net neutrality requirements. In part this is because known instances of outright blocking/degradation of services have been relatively rare, and regulators have been concerned of over-regulating a problem that might not exist and that may have unforeseen impacts on network reliability and security. Disclosure and transparency requirements are thus often seen as a first or interim step, with further regulation to be applied only if necessary.

- **Tiered data plans:** Net neutrality rules generally permit, and even encourage, operators to offer tiered data plans with data caps. This means that subscribers could choose in advance how much data they want to purchase, with multiple price/cap levels available. There may also be rules requiring operators to notify a subscriber who is about to reach his data limit and/or allow him to upgrade to a higher tier.

Box 6. Recent changes in net neutrality

Brazil

Brazil's net neutrality bill, called Marco Civil or Internet Civil Framework, was signed into law in April 2014. Among other principles related to the use and provision of Internet services, the law also establishes the principle of net neutrality and requires ISPs to abide by non-discrimination principles of no blocking or degrading traffic, unless necessary for technical reasons or emergency situations. There are also disclosure and transparency obligations. The law calls for a Presidential Decree to further regulate the net neutrality principle and traffic management practices.

Canada

The CRTC issued net neutrality rules in 2009 that prohibit blocking or degrading of content except in certain circumstances, such as traffic management during congested period. The rules also require disclosure of any network management practices. In January 2012, the CRTC notified fixed line operator Rogers that there was evidence of violation of net neutrality rules through deliberate throttling of some applications, particularly online video games. In response, Rogers stated that it would stop throttling traffic by the end of 2012. In June 2013, the CRTC accepted this response and closed the investigation.[1]

Europe

In April 2014, the European Parliament voted overwhelmingly in favor of stringent net neutrality regulations requiring all broadband providers (both fixed line and mobile) to treat all Internet traffic equally. To become EU-wide law, the Council of Ministers must vote in favor of the bill in October of this year. The basic principles of Europe's net neutrality bill are:

- No blocking or degrading traffic, even if an application competes with an operator's services. This would ban the current practice by several mobile operators throughout Europe who currently block or charge for Skype.
- No prioritization of traffic. Thus, an OTT provider would be prohibited from paying an operator to deliver its traffic faster than other traffic.
- Tiered data plans and data caps are allowed, but must be clearly disclosed to consumers.
- Traffic management is allowed, but only on a temporary basis, such as to ease network congestion during peak-use times.

[1] CRTC, CRTC investigation prompts Rogers to stop slowing down Internet traffic, Press Release, June 28, 2012 at http://www.crtc.gc.ca/eng/com100/2012/r120628.htm.

United States
In 2010, the U.S. Federal Communications Commission ("FCC") adopted net neutrality regulation based on principles of non-discrimination (i.e., no blocking or degrading) and no prioritization, except where necessary for reasonable network management practices, such as to resolve network congestion during peak-use periods. However, Verizon filed a claim against the FCC on grounds that the rules were not founded on a sound legal basis. In February 2014, a U.S. court rejected the FCC's attempt to ensure net neutrality, finding that although the FCC holds authority to impose net neutrality rules, the regulator must provide a different legal justification on which the rules would be based.

In May 2014, the FCC opened a consultation that proposes amended rules that outlines unacceptable practices for broadband providers, and provides for case-by-case enforcement when content providers or users complain of unfair discrimination. Transparency rules would require ISPs to file publicly available reports with information on the actual Internet speeds they deliver, instances of network congestion, actual instances when they block content or any paid prioritization agreements. Supporters of net neutrality are dismayed that the rules permit paid prioritization, claiming that this will create a two-tiered Internet in which large, established content companies get better access to consumers, while smaller competitors would be disadvantaged. They also claim that consumers will likely suffer due to more limited choice in services.

Sources:
The Internet Civil Framework is established through Law 12965 of April 23, 2014, that implements principles, guarantees, and rights on the use of Internet in Brazil, available at http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l12965.htm
http://www.fcc.gov/document/statement-fcc-chairman-tom-wheeler-fccs-open-internet-rules;
http://gigaom.com/2014/04/03/european-parliament-passes-strong-net-neutrality-law-along-with-major-roaming-reforms/

4.5.2 Sponsored data plans: neutral or not?

Whether supportive or opposed to net neutrality regulation, the principles at a high level – no blocking, no discrimination and no prioritization – seem straightforward. However, the issue of net neutrality sometimes becomes murkier when looking at these principles in the context of some of the new business models that are emerging. For example, to stimulate consumer demand for their services, a relatively new commercial practice has developed in the retail mobile broadband market, called sponsored data programs. Under these programs, among other variants, content providers pay mobile operators to deliver their content without such use counting towards the subscriber's data plan. In some cases, the subscriber may not need a data plan at all in order to access the sponsored content. Other alternatives include operators themselves sponsoring access to third party content, or even their own content, with such usage not counting towards subscriber's data caps.

Sponsored data programs represent a new revenue source for operators and can benefit consumers as well. In April 2014, a U.S. consumer survey found that 71 per cent of men and 62 per cent of women surveyed were more willing to increase their data usage if their data plans included sponsored data programs.[57] These subscribers identified several types of content that they most likely would use if

[57] Citrix, "Mobile Data Users Fear Exceeding Their Quota, Open to Sponsored Data Plans," 16 April 2014, http://www.citrix.com/news/announcements/apr-2014/citrix--mobile-data-users-fear-exceeding-their-quota--open-to-sp.html.

offered through a sponsored data program, including mobile banking, educational videos, viewing advertisements, and holding a teleconference. Such programs have been introduced around the world. For example, Facebook Zero, started in 2010 and available in numerous countries in Asia, the Americas, Europe, Middle East, and Africa[58] enables smartphone users to connect to a text-only version of Facebook's mobile site without incurring data charges. In 2012, Wikipedia began sponsoring access to its site also through their Wikipedia Zero program, allowing users in India, Jordan, Malaysia, Pakistan, Saudi Arabia, Sri Lanka and Thailand to access Wikipedia's content without it counting towards the users' data plans.

Some argue that sponsored mobile data programs fall outside net neutrality rules because, provided the sponsored traffic is not prioritized, there is no discrimination, blocking, or prioritization of sponsored content vis-à-vis non-sponsored content. However, some net neutrality advocates assert that such programs are within the realm of net neutrality because, under certain scenario, content providers may be paying operators for access to customers. They claim that this practice could have a negative impact on content providers by increasing their costs overall. These costs may be passed on to consumers or may diminish investments in new content. Additionally, opponents to sponsored data programs argue that large content providers with deep pockets can pay for sponsored data and may potentially squeeze out smaller content developers and start-ups that cannot afford sponsored content.

Regardless of whether net neutrality rules apply to sponsored data programs, other competition issues could arise if an operator is sponsoring its own content in direct competition with other OTT apps. One such case is pending before the Canadian Radio-television and Telecommunications Commission (CRTC). Although the CRTC's investigation into the matter is ongoing, the case demonstrates challenges associated with balancing the benefits of new business models and consumer choice along with ensuring that these practices do not allow dominant operators to leverage market power and stifle competition.

Box 7. Sponsored data program and competition in Canada

In November 2013, a Canadian citizen filed a complaint with the CRTC over the practice of mobile operator, Bell Mobility, offering a sponsored mobile TV service.[59] For CAD 5 per month, Bell Mobility subscribers can watch 10 hours of video (equivalent to about 5 GB of data) from over 40 Bell-owned or licensed TV channels without it counting towards the subscribers' data plan.[60] These same TV channels are available via other OTT applications; however, viewing video through these other applications would count against the subscribers' monthly data caps. To get the equivalent amount of video that the Mobile TV sponsored program provides, a subscriber would need to purchase a CAD 40 per month plan for tablets or a CAD 105 per month plan for smartphones, resulting in a markup of non-sponsored content of several hundred per cent. The complaint alleges that Bell Mobility is leveraging its large market share and vertical integration in the video programming market to give itself undue preference.

[58] The countries include Australia, Bangladesh, Cameroon, Canada, El Salvador, France, Guinea, Indonesia, Malaysia, New Zealand, Philippines, Qatar, Suriname, Trinidad and Tobago, Pakistan and the United Kingdom,

[59] CRTC, "Application requesting fair treatment of Internet services by Bell Mobility," Part 1 Proceeding, 22 November 2013, https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?Lang=eng&YA=2013&S=C&PA=t&PT=pt1&PST=a.

[60] Kazi Stastna, "Bell's discounting of mobile TV against the rules, complaint claims," CBC News, 16 December 2013, http://www.cbc.ca/m/touch/news/story/1.2445059.

Sources: CRTC and CBC News.

4.5.3 Quality of service monitoring

The level of regulatory intervention with respect to quality of service is often dependent on the degree of competitiveness in the market. Regulators typically take a hands-off approach in monitoring quality of service and reporting requirements if a market is highly competitive. In markets where competition proves not to be effective, and poor quality of service becomes an issue, regulators have intervened. Historically, quality of service requirements have been applied to voice services, but most recently regulators have been incorporating net neutrality principles into minimum quality of service requirements for data services. These requirements can vary from high-level transparency guidelines on how the information on traffic management techniques is disclosed to end-users, to requiring actual indicators for data network performance for fixed and mobile broadband providers.

In 2011, the U.K. regulator, Ofcom, issued a statement recognizing the risk of network operators entering into discriminatory blocking and unreasonable network management practices. Ofcom noted that if complaints were received, the regulator would consider using its authority to insure "best-effort" access to the Internet by imposing a minimum quality of service on all providers. However, Ofcom also stated its belief that there was sufficient competition in the U.K. market to discourage discriminatory blocking and prioritization of data traffic. Nonetheless, Ofcom also noted that effective competition requires that sufficient information be available to users, and that it would be monitoring market practices in that regard.[61]

The French regulator ARCEP also issued network neutrality principles in 2010. Among those principles, ARCEP noted that it was necessary to promote transparency to users, monitor data traffic management practices, and conduct regular evaluations of quality of services. [62] In 2012, ARCEP issued a statement to the French Parliament noting that there was a decrease on all discriminatory management practices particularly because of the increased competition in the market. [63]

Some countries have imposed very detailed and specific market regulations regarding quality of service, even though the market is regarded as competitive, but not efficiently competitive.[64] The Chilean Senate is currently discussing a bill that would oblige both fixed and mobile operators to assure a minimum Internet speed to users. According to the bill, ISPs must guarantee 70 per cent of advertised speed for national connections and 50 per cent in the case of international connections. In the case of mobile connectivity, providers must guarantee 60 per cent of domestic and 40 per cent of international advertised speed.[65]

[62] OECD, Communications Outlook 2013, at 48.

[63] OECD, Communications Outlook 2013, at 48.

[64] Brazil has four major mobile operators and each having approximately 25 percent market share by subscribers.

[65] "Proyecto que garantiza velocidade minima de acesso a Internet es aprobado en general en el Senado" http://www.subtel.gob.cl/noticias/138-neutralidad-red/5298-proyecto-que-garantiza-velocidad-minima-de-acceso-a-internet-es-aprobado-en-general-en-el-senado

In 2011, the Brazilian regulator Anatel approved two regulations establishing targets for network management and transparency requirements for both mobile and fixed broadband providers.[66] Both regulations establish minimum indicators for data network performance for mobile and fixed broadband providers, as well as minimum rates of complaints and customer service. Some of the requirements applied to mobile data providers in Brazil include the following:[67]

- Connection attempts of data services during periods of high mobile data traffic should be connected in at least 98 per cent of cases
- During each period of high mobile data traffic, the rate at which an operator's data services network is down must be less than 5 per cent per month
- During each period of high mobile data traffic, the operator must ensure that the instant transmission rate of data services, whether downloading or uploading, in 95 per cent of cases each month is 40% of the maximum rate contracted by the user
- The operator must ensure that the average transmission rate during high mobile data traffic, whether downloading or uploading, of data services must be at least 80% of the maximum transmission rate contracted by the user
- Data services may not make voice communications unfeasible.

Regulators in other countries have also raised concerns over the quality of mobile telecommunication services provided in their respective countries. In response, policymakers are considering a variety of remedies, such as fines, the cancellation of mobile operator licenses or the suspension of new customer acquisitions unless certain quality of service standards are met (see Box 8) .[68]

Box 8: Brazil Bans Mobile Operators from Selling Mobile Connections Due to Poor Quality of Service

Under Brazilian rules, companies that do not meet the quality of service target indicators will be subject to fines and sanctions. Based on the increasing number of user complaints for poor service quality,[69] on July 23, 2012, Anatel issued a series of preliminary decisions temporarily banning thee of the four mobile operators (Tim Cellular S/A/, Group Claro, and Group Oi) from selling and activating new mobile connections in certain states.[70] These operators were singled out because they had the highest index of user complaints due to poor network performance in each of the 26 states and the Federal District, from the period of January to June 2012.[71]

[66] Quality of Service for the Provision of Mobile Service Regulation is established through Resolution 575/2011 (Regulamento de Gestão de Qualidade de Prestação do Serviço Móvel Pessoal-RGQ-SMP) *available* at http://legislacao.anatel.gov.br/resolucoes/26-2011/68-resolucao-575 and the Quality of Service for the Provision of Multimedia Communication Services is established through Resolution 574/2011 *available at* http://legislacao.anatel.gov.br/resolucoes/26-2011/57-resolucao-574.

[67] Based on Anatel's Resolution 575/2011 and Anatel's Press Release announcing the ban on sale of mobile subscriptions on July 23, 2012.

[68] http://www.oafrica.com/mobile/quality-of-service-stressed-in-a-growing-number-of-african-nations/

[69] *See* Anatel's Press Release announcing the ban on sale of mobile subscriptions on July 23, 2012.

[70] *See* Decision No. 4783, applicable to Tim; Decision No 4787 applicable to Claro; and Decision No. 4789 applicable to Oi, that were issued July 18, 2012.

[71] The index of complaints from January-June 2012 was measured with the following formula: Index of complaint = number of complaints/ total number of subscribers in the state in June-2012. Results are available here.

Although operators resumed their operations on an average of a month after Anatel's sale ban, Anatel continues to monitor their quality of service indicators and have recently noted to the press that operators have not achieved their target obligations of quality and that the regulator is preparing a new package of quality of service obligations to apply on mobile providers, particularly with regard to data service.[72]

4.6 Internet Interconnection

As noted in section 3.1.3, the Internet interconnection market is becoming increasingly complex. From a policy perspective, the key question is whether these developments may lead to market failure and the ability for certain players within the value chain to exercise market power.[73] To date, Internet interconnection has remained largely unregulated, as privately negotiated agreements have resulted in efficient outcomes. The use of peering and transit arrangements has been effective in controlling any potential exercise of market power, especially considering the continued reductions in IP transit costs over the last several years.[74] If a larger network refuses to peer, the argument goes, the smaller network can still reach its users via transit.[75] However, not all Internet traffic is equal. This is especially the case for highly latency-sensitive traffic, such as video streaming. In such cases, it could be argued that despite low prices, IP transit may not be a good work around for cases where an ISP refuses to peer.

As expected, there are proponents on both sides of the issue. Very public disputes between content providers and CDNs, on one side, and large ISPs, on the other, have led the former to call for regulatory action in the Internet interconnection market (Box 9). They argue that large ISPs have market power in terminating traffic, as their subscribers are locked-in, and are exercising it by demanding payments from CPs and CDNs. Large ISPs, on the other hand, argue that paid-peering arrangements with CDNs have been the norm and that just because new players, such as backbone providers and CPs, are becoming CDNs does not justify any changes in the Internet interconnection framework.[76] As such, ISPs argue that

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[72] "Anatel não está satisfeita com qalidade dos serviços movies e prepara novas exigências," Teletime, May 20, 2014 http://www.teletime.com.br/20/05/2014/anatel-nao-esta-satisfeita-com-qualidade-dos-servicos-moveis-e-prepara-novas-exigencias/tt/378160/news.aspx

[73] Some commentators argue that, considering the success of unregulated Internet interconnection arrangements to date, private agreements should continue to be applied and that "[a] very high threshold of market failure should be established to justify intervention in the Internet market." *See* OECD, Internet Traffic Exchange Market Developments and Policy Challenges, 31 January 2013, *available at* http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP%282011%292/FINAL&docLanguage=En.

[74] *See* William B. Norton, Internet Transit Pricing – Historical and Projected, DrPeering.net, 2011, at http://drpeering.net/white-papers/Internet-Transit-Pricing-Historical-And-Projected.php.

[75] The European Commission has supported the view that peering and transit are demand-side substitutes and should be included within the same broader relevant market. *See* Commission Decision of 3 March 2010 pursuant to Article 7(4) of Directive 2002/21/EC (Withdrawal of notified draft measures). Case PL/2009/1019: The wholesale national market for IP traffic exchange (IP transit). Case PL/2009/1020, at paragraph 36, *available at* http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/poland/registered_notifications/pl20091019-1020/act_part1_v4pdf/_EN_1.0_&a=d

[76] *See*, for example, Jennifer Khoury, Comcast Response to Netflix's Opposition to Time Warner Cable Transaction, Comcast Voices, 21 April 2014, *available at* http://corporate.comcast.com/comcast-voices/comcast-response-to-netflixs-opposition-to-time-warner-cable-transaction. *See also*, Letter from Ian Dillner, Vice President, Federal

they should be compensated for the use of their networks, especially considering the significant demands placed on them by the increased volume of traffic being exchanged.[77]

Box 9: Evolving landscape of traffic exchange between content providers, CDNs and large ISP – the case of the U.S. (2011-2014)

The Level 3-Comcast interconnection dispute that took place in the United States exemplifies the types of disputes that may arise due to shifts within the Internet ecosystem and changing roles of existing players. As a major U.S. backbone provider, Level 3 engages in settlement-free peering with Comcast, the country's largest ISP. In 2010, Level 3 entered into an agreement with Netflix, a subscription-based OTT content provider that allows users to stream TV shows and movies over their Internet connection.[78] Netflix requires high-quality and dedicated connectivity to end users to deliver its services. To drive revenues, Level 3 agreed to deliver Netflix's video content for a fee, thereby acting as a CDN. Since Netflix represents 30 per cent of peak U.S. broadband traffic, the deal meant that Level 3 began sending huge amounts of traffic for Comcast to terminate—much more than Comcast sent to Level 3. Comcast eventually issued an ultimatum: Level 3 had to pay Comcast to deliver Netflix's video content like any other CDN or else Comcast would not deliver the additional traffic. Level 3 took the issue to the FCC, but did not file a formal complaint and the parties eventually resolved the dispute in 2013 through negotiations. Although terms of the deal were not disclosed, it is understood that the parties reached an agreement to share the costs of increased traffic.

On February 24, 2014 Netflix signed a deal with Comcast which allowed Netflix's CDN (Open Connect)[79] to directly interconnect with Comcast's servers and cache its video content closer to Comcast's subscribers. By doing this, Netflix cut out the wholesalers that previously transited its traffic to Comcast. Prior to reaching this agreement, Netflix had reported that delivery speed of its content to Comcast subscribers had declined by more than 25 per cent, resulting in frequent interruptions and delays of its service.[80] Comcast denied that it was slowing Netflix's traffic and instead blamed intermediate CDNs for poor traffic management.[81]

Despite reaching agreements with Comcast, Level 3 and Netflix have claimed that Comcast and other

Regulatory Affairs, Verizon, to Marlene Dortch, Secretary, FCC, Preserving the Open Internet, GN Docket No. 09-191, 13 January 2011, *available at* http://apps.fcc.gov/ecfs/document/view?id=7021025758.

[77] In 2012, the association of European Telecommunications Network Operators (ETNO) – whose members include Orange, Deutsche Telekom, Telefónica and Telecom Italia – proposed to amend Article 3 of the International Telecommunications Regulations with language that would results in OTT providers paying for the termination of traffic. ETNO argued that this charging mechanism for interconnection would be consistent with the principle "sending party network pays" used in some telecommunication services for the Internet, and would ensure the sustainability of the Internet ecosystem and allow all stakeholders to invest and innovate. *See* OECD Communications Outlook 2013, p. 49.

[78] Drew Fitzgerald, "Level 3, Comcast Reach Accord on Internet Traffic Costs," Wall Street Journal, 16 July 2013, http://online.wsj.com/news/articles/SB10001424127887323394504578609963298727892.

[79] Netflix deployed its Open Connect CDN and migrated most of its traffic to this platform. *See* http://conferences.infotoday.com/documents/197/2014CDNSummit-Netflix.pdf.

[80] Edward Wyatt and Noam Cohen, Comcast and Netflix Reach Deal on Service, The New York Times, 23 February 23, 2014.

[81] *Id.*

ISPs are using their position in the Internet ecosystem to create a bottleneck and charging interconnection fees for CDNs and content providers to reach end users.[82] In March 2014, Level 3 proposed a new rule to the FCC that would require ISPs to provide CDNs interconnect on "commercially reasonable terms, without the payment of an access charge."[83]

Source: Authors

While the issue is still unsettled, some regulatory authorities and analysts agree that greater transparency in the Internet interconnection market is needed. For example, calls for transparency have been made recently in order to ensure that better information is available about traffic patterns, the costs of increased usage and the terms, conditions, and norms that are emerging as Internet interconnection markets continue to evolve. Increased transparency may face certain challenges, however, since the great majority of peering agreements are not written contracts. Despite this, some regulatory authorities have begun to take steps in order to obtain information relating to Internet interconnection relationships.

For example, in 2012 the French regulator, ARCEP, imposed a requirement on ISPs to provide information on a biannual basis on the technical and pricing terms governing data conveyance and interconnection.[84] After a two year review, ARCEP found there was no need to impose specific *ex ante* regulatory obligations in the Internet interconnection market (e.g., obligation to provide interconnection, rate regulation, etc.).[85] Instead, ARCEP continued its light-handed regulatory approach of collecting information from market participants which allows the regulator to monitor Internet interconnection markets more closely.

In any case, close review of traffic flows, and the terms, conditions and commercial practices is advisable prior to any policy decision in this area. Further transparency in this market will be essential to monitor the continued development of interconnection and allow evidence-based decision making going forward in order to assess whether there is significant market failure that warrants intervention by regulatory authorities.

4.7 Mechanisms to enhance and protect consumer choice

[82] Stacey Higginbotham, "Here is Level 3's plan to make interconnection fees a network neutrality issue," Gigaom, 21 March 2014, https://gigaom.com/2014/03/21/here-is-level-3s-plan-to-make-interconnection-fees-a-network-neutrality-issue/. *See* also, Reed Hastings, Internet Tolls And The Case For Strong Net Neutrality, Netflix Blog, 20 March 2014, *available at* http://blog.netflix.com/2014/03/internet-tolls-and-case-for-strong-net.html.

[83] Stacey Higginbotham, "Here is Level 3's plan to make interconnection fees a network neutrality issue," Gigaom, 21 March 2014, https://gigaom.com/2014/03/21/here-is-level-3s-plan-to-make-interconnection-fees-a-network-neutrality-issue/.

[84] David Clark, *et al.,* Interconnection in the Internet: the policy challenge, The 39th Research Conference on Communication, Information and Internet Policy, George Mason University, 9 August 2011, *available at* http://groups.csail.mit.edu/ana/Publications/Interconnection_in_the_Internet_the_policy_challenge_tprc-2011.pdf.

[85] A survey of 142,000 peering agreements published in 2013 found that 99.5% of interconnection agreements are concluded without a writ en contract. This is, however, suggestive of generally accepted standard terms and conditions for these types of agreements. *See* OECD, Internet Traffic Exchange Market Developments and Policy Challenges.

A framework focused on enhancing competition is essential to the development of a thriving ICT sector, but should also be complemented by measures that help ensure consumers make informed decisions and reap maximum quality for price from the variety of service providers. Service providers have an obvious incentive to keep their customers and can use several strategies to stop them from leaving. Some of these are good for competition; lowering prices, for example or offering new attractive services.

However, other practices may be seen as denying customers the ability to switch providers, essentially locking them to their existing provider in such a way that it is impossible or extremely difficult (or costly) for competitors to actually gain their business. In some cases, activities that prevent subscribers from switching providers may be anti-competitive, such as collusion between competitors to maintain certain market shares or carve out geographic territories in which they will not compete with each other. However, it is often the case that the same activity may be either a sign of a competitive market that benefits consumers through greater choice in service offerings or an anti-competitive practice if a provider is exploiting its market dominance to artificially limit competition and market access, raise prices or reduce output.[86] In more mature competitive markets, these issues are increasingly confronting regulators seeking to maximize the benefits of competition.

4.7.1 Contractual obligations

In order to take advantage of a competitive environment, consumers must be able to effectively choose amongst service providers. While disclosure and transparency on prices and service quality are important to ensure consumers can make informed decisions prior to signing on with a service provider, it is also important for consumers to be able to switch from one provider to another. Customer lock-in can become both a competition and a consumer protection issue.

For example, long-term customer contracts lock customers in for one or two years, and it can be difficult for customers to break the contract without paying high early termination fees (ETFs). Notably, the 2009 amendments to the EU Universal Service Directive 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.[87] However, the benefit to these long-term contracts is that customers often receive heavily discounted rates and/or a subsidized handset for mobile services. In such instances, customers opt to be locked into a certain provider in order to take advantage of such cost-savings. These practices also give operators another means by which to compete and diversify their service offerings.

Despite the benefits, regulators may occasionally become concerned with ETFs, especially if such fees are not clearly disclosed to consumers or seem excessive. In April 2012, for example, Israel's Ministry of Communications banned all ETFs for mobile services and backdated the ban for any customer with 100 or fewer mobile subscriptions (i.e., non-enterprise customers) who signed a mobile contract after

[86] Organisation for Economic Co-operation and Development, "Anticompetitive Practices," http://stats.oecd.org/glossary/detail.asp?ID=3145.

[87] 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://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0136&from=EN.

November 1, 2011.[88] For customers who signed a contract before that date, an 8 per cent fee based on the customer's monthly bill multiplied by the number of months remaining on the contract applies. The ban on ETFs does not include recovering remaining payments for subsidized handsets; mobile customers breaking their contracts can still be charged for the balance of any handset subsidy.

4.7.2 Number portability

Another measure that regulators adopt to facilitate consumer choice is number portability, which allows customers to keep the same telephone number when they switch carriers. Because people and businesses become closely associated with their phone numbers, having to change that number as a result of switching carriers is often seen as a burden that will keep subscribers from moving to a new carrier. In such cases, even if a competitor provides a better and/or less expensive service, subscribers will not switch because they will lose their long-held existing number. Such a barrier can undermine the development of a truly competitive network. Number portability rules also generally include measures to streamline the porting process, and further encourage consumers to take advantage of competition. Although policymakers often require fixed line operators to port numbers, mobile number portability is more common, both as a regulatory obligation and consumer practice, which may be due to greater levels of competition (and therefore choice) in the mobile market generally. For example, since Mexico first introduced fixed line and mobile number portability in 2008, over 14 million numbers have been ported, nearly 90 per cent of which was subscribers moving between mobile operators.[89]

According to ITU data, the implementation of mobile number portability is on the rise with a sharp uptick over the last several years. In 2008, 46 per cent of the countries responding to the annual Telecommunication Regulatory survey reported that mobile number portability rules had been adopted—by 2013, this figure reached more than 90 per cent of surveyed countries.[90] For fixed line portability, the percentage has remained more or less constant since 2008, with approximately 44 per cent of countries reporting that they require fixed line number portability.

Number portability rules typically outline the steps consumers must take, and the process that operators must follow, a timeframe in which operators must complete the process, and may also include limits on the amount that operators may charge consumers to port a number. Bahrain's Telecommunications Regulatory Authority (TRA), for example, requires no customer involvement beyond the initial application for service with the new provider and it is incumbent on the two providers to port the number.[91] Mexico's telecommunications regulator, IFT, has also sought to simplify and bring transparency to the number portability process, including new rules issued in May 2014 requiring mobile operators to send customers a standardized text message with instructions and a code to switch. The European Union has also adopted measures, set forth in the Universal Service Directive amended in

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[88] Cellular News, "Israel Bans Early Termination Fees," 3 April 2012, http://www.cellular-news.com/story/Regulatory/53786.php.

[89] TeleGeography, "Ifetel Standardises Number Portability Process," 9 May 2014, http://www.telegeography.com/products/commsupdate/articles/2014/05/09/ifetel-standardises-number-portability-process/?utm_source=CommsUpdate&utm_campaign=48a3913c1f-CommsUpdate+09+May+2014&utm_medium=email&utm_term=0_0688983330-48a3913c1f-8837629.

[90] ITU, ICT-Eye, http://www.itu.int/net4/itu-d/icteye/.

[91] TRA, "Important Information on Number Portability," 19 May 2012, http://www.tra.org.bh/en/press-releases/important-information-on-number-portability.html.

2009, to speed up the porting process by requiring operators to port both fixed line and mobile numbers within one working day.[92] However, this ambitious deadline is proving difficult to meet—only operators in Ireland port both fixed line and mobile numbers within one working day while operators in all other EU Member States take at least two working days and up to two weeks to port a number.[93]

4.7.3 Interoperability

Interoperability refers to the ability of one device to communicate and exchange information with another device, with both devices able to understand and use the information. Interoperability in a broadband environment is important for ensuring that software and equipment from different operators, manufacturers and vendors work together seamlessly to deliver broadband services and applications to consumers. A lack of interoperable products can impede the ability for customers to switch providers (particularly if the products are costly) and reduce consumer choice even if there are otherwise a variety of services and devices available in the market. To facilitate choice and ease of access, many view common, open standards as key to ensuring interoperability. However, there are multiple benefits to proprietary standards. Manufacturers, software developers, and operators may create or license proprietary systems to maintain greater control over the quality and security of the products, which also benefits consumers, particularly if they are seeking a customized, secure product...

As defined by the ITU-T, open standards "are standards made available to the general public and are developed (or approved) and maintained via a collaborative and consensus driven process… open standards facilitate interoperability and data exchange among different products or services and are intended for widespread adoption."[94] (See Box 10) for other elements of open standards.) Standard-setting organizations provide rules governing consensus-based decision-making processes and the development of open standard specifications, including the ITU, International Organization for Standardization (ISO), International Electro technical Commission (IEC), Institute of Electrical and Electronics Engineers (IEEE) and European Telecommunications Standards Institute (ETSI).[95] When software, content and devices are based on open standards, any telecommunications service provider or end user can select those products that suit their needs and—importantly—use the same devices or software with a different provider without losing functionality of their data or needing to go through lengthy processes to retrieve their data.[96]

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[92] 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://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0136&from=EN.

[93] CEPT, "Number Portability Implementation in Europe," 14 March 2014, http://www.cept.org/files/5466/documents/Number%20Portability%20Impementation%20in%20Europe%20-%20based%20on%20a%20survey%20of%20CEPT%20member%20countries%20-%20March%202014.pdf.

[94] ITU-T, "Definition of Open Standards," 2005, http://www.itu.int/en/ITU-T/ipr/Pages/open.aspx.

[95] Rudi Bekkers, "The Role of Standards in a Digital Economy," GSR-13: Discussion Paper, 2013, http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/Role%20of%20Standards%20in%20a%20Digital%20Economy.pdf.

[96] ECIS, "Interoperability and Open Standards," http://www.ecis.eu/open-standards/.

Box 10. Elements of open standards

- **Collaborative process** – voluntary and market driven development (or approval) following a transparent consensus driven process that is reasonably open to all interested parties.
- **Reasonably balanced** – ensures that the process is not dominated by any one interest group.
- **Due process** - includes consideration of and response to comments by interested parties.
- **Intellectual property rights (IPRs)** – IPRs essential to implement the standard to be licensed to all applicants on a worldwide, non-discriminatory basis, either (1) for free and under other reasonable terms and conditions or (2) on reasonable terms and conditions (which may include monetary compensation). Negotiations are left to the parties concerned and are performed outside the SDO.
- **Quality and level of detail** – sufficient to permit the development of a variety of competing implementations of interoperable products or services. Standardized interfaces are not hidden, or controlled other than by the SDO promulgating the standard.
- **Publicly available** – easily available for implementation and use, at a reasonable price. Publication of the text of a standard by others is permitted only with the prior approval of the SDO.
- **On-going support** – maintained and supported over a long period of time.

Source: ITU-T, "Definition of Open Standards," 2005, http://www.itu.int/en/ITU-T/ipr/Pages/open.aspx.

In contrast, providers of devices and software based on proprietary systems develop their standards without outside input and often do not license or make their standards public. In addition, they typically restrict which vendors can use their standard, charge higher licensing fees than products based on open standards and retain control over the specifications. Nonetheless, proprietary systems must still maintain some degree of interoperability in order to provide connectivity and value to the consumer. For example, Microsoft Word is proprietary software, but may be used with a variety of devices and operating systems, and can be used by different, but compatible, such as Adobe Acrobat or LibreOffice. Nonetheless, proprietary systems are more likely to result in consumer lock-in whereby data portability is hindered.

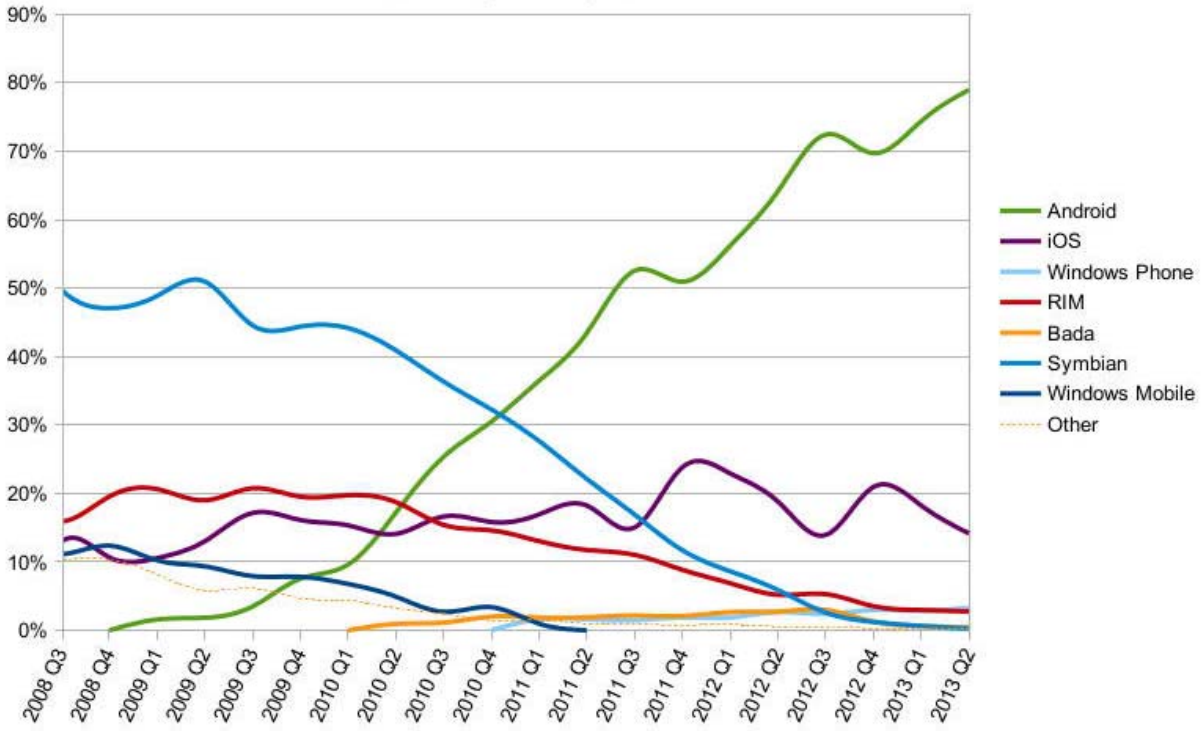
Proprietary systems may be more common when certain technologies are nascent and as expertise in the new technologies develop, sharing of standards also develops. Additionally, because proprietary standards yield higher licensing fees (and therefore revenues), a company may adopt proprietary standards if it believes its product is strong enough to succeed in the market.[97] For example, Apple first released its iPhone (based on a proprietary system) in 2007 with Google introducing its open standard Android operating system over a year later.

While Apple has maintained tight control over its devices, iOS operating system, software and app development, Google sought to build on its share of the app market by allowing any device maker to use its Android operating system through a much more open platform for app development. The tactic has paid off for Google. In terms of the number of devices sold globally using the companies' respective operating systems, Android has far outpaced iOS. As shown in Figure 7, Android went from zero market

[97] Rudi Bekkers, "The Role of Standards in a Digital Economy," GSR-13: Discussion Paper, 2013, http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/Role%20of%20Standards%20in%20a%20Digital%20Economy.pdf.

share at the end of 2008 to nearly 80 per cent market share by the middle of 2013.[98] In contrast, the iOS operating system has hovered from 10 to 25 per cent during the same period, with about 15 per cent market share worldwide by the middle of 2013. Notably, however, as Android-based devices and apps have gained market share, Google has more recently "closed" many of its Google-developed applications, including the company's search, maps, calendar, music, and messaging apps.[99]

Figure 7. Smartphone market share worldwide (2008-2013)



Source: ARS Technica, Google's iron grip on Android: Controlling open source by any means necessary, 20 October 2013.

While both proprietary and open source systems provide consumers a wider variety of choice, there are instances in which proprietary models can negatively impact consumers and limit competition. Cloud-based services represent an area in which interoperability among platforms and data portability are often an issue because different cloud service vendors often use different combinations of operating systems and databases with their own processes, security mechanisms, and storage, licensing and networking models.[100] This means that even if there are certain common elements between two cloud providers, it is highly unlikely that all elements will be the same. Thus, customers are often not able to easily migrate from one provider to another and continue to use the same applications and software.

[98] Ron Amadeo, "Google's iron grip on Android: Controlling open source by any means necessary," ARS Technica, 20 October 2013, http://arstechnica.com/gadgets/2013/10/googles-iron-grip-on-android-controlling-open-source-by-any-means-necessary/.

[99] Ron Amadeo, "Google's iron grip on Android: Controlling open source by any means necessary," ARS Technica, 20 October 2013, http://arstechnica.com/gadgets/2013/10/googles-iron-grip-on-android-controlling-open-source-by-any-means-necessary/.

[100] Bill Claybrook, "Cloud interoperability: Problems and best practices," 1 June 2011, Computer World, https://www.computerworld.com/s/article/9217158/Cloud_interoperability_Problems_and_best_practices.

Instead, migration from one cloud provider can require separating all data and processes from their original ecosystem and re-engineering them for the new cloud service. To resolve these issues, developers are working on a cloud standard using an open standards approach that would better enable enterprise customers to move large amounts of data from one provider to another.[101] As cloud services develop, open standards to support interoperability are likely to develop as well.

For example, the European Union is working towards facilitating interoperability and the portability of data from one cloud provider to another. In 2012, the European Commission drafted model contract terms and conditions for businesses in Europe to use—on a voluntary basis—for contracts and service level agreements with cloud computing providers.[102] To provide guidance on the model contract, the European Parliament submitted recommendations to the Commission seeking inclusion of language in the model contract to promote competition among cloud providers.[103] The recommendations include adopting standards and specifications that allow for easy and complete data and service portability; ensuring a high degree of interoperability between cloud services in order to promote competition among cloud providers; and ensuring that consumer devices do not restrict users to any specific cloud service provider.

Another issue that arises with interoperability relates to customer equipment. Service providers may sell customer equipment that is technically incompatible with their competitors; such that the equipment will not work if the end user tries to switch carriers. Thus, if a user wants to switch, he or she will have to buy new equipment and incur a potentially significant expense (in the case of a business switching, all devices would have to be replaced), which can obviously reduce the incentive to switch. For example, the U.S. FCC issued an order in 2013 to amend spectrum licenses in the 700 MHz band to ensure interoperability and the ability for users to roam on competing providers' networks.[104] The issue arose in 2008 after the close of the 700 MHz auction in which device makers began manufacturing LTE devices that filtered out all frequencies other than those specifically assigned to the large mobile operators, AT&T and Verizon. Rather than enable use for the entire 700 MHz band, devices with these "narrow" filters function only on certain frequency blocks. This placed smaller regional and rural mobile operators at a severe competitive disadvantage because AT&T and Verizon subscribers using these devices could not roam onto the smaller operators' networks. This also limited consumer choice by rendering their devices useless except in those areas where their carrier had deployed LTE networks. In order to switch from one provider to another, consumers needed to purchase a new device even if operators were using the same technology. To remedy the problem, the FCC amended the 700 MHz licenses to ensure that devices using this band do not contain narrow filters, but allow for use on the entire band.

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[101] Bill Claybrook, "Cloud interoperability: Problems and best practices," 1 June 2011, Computer World, https://www.computerworld.com/s/article/9217158/Cloud_interoperability_Problems_and_best_practices

[102] European Commission, "European Cloud Computing Strategy," September 2012, http://ec.europa.eu/digital-agenda/en/european-cloud-computing-strategy.

[103] European Parliament, "European Parliament resolution of 10 December 2013 on unleashing the potential of cloud computing in Europe (2013/2063(INI))," 10 December 2013, http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2013-0535&format=XML&language=EN.

[104] Federal Communications Commission, "In the Matter of Promoting Interoperability in the 700 MHz band," 29 October 2013, http://www.fcc.gov/document/700-mhz-interoperability.

5 CONCLUSION

Policymakers and regulators are facing an increasingly complex ICT regulatory environment due to the convergence of services, the entry of new players with new business models and cost structures, and rapidly increasing flows of data throughout the world. As a result, the competitive landscape is significantly different than it was only a few years ago, and this change seems poised to accelerate as technology advances and consumer demands change. Competition issues have become more complex as market definitions have become less distinct and companies compete in various links in the broadband value chain. New business models are being devised and discarded at an amazing speed. In an effort to address the changes in the ICT market, policymakers and regulators are engaged in a variety of efforts to ensure that competition and innovation can continue to flourish. In some cases, these efforts are aimed at opening the market to new competition or restraining the power of a still-dominant incumbent operator (i.e., licensing reforms, access obligations, vertical integration, net neutrality, and consumer protections). In others, regulators seek to fine tune measures to promote competition to ensure that networks can be expanded and continue to grow as consumers demand and markets dictate faster, ubiquitous, more reliable and more secure services. As the markets and technologies continue to evolve, policymakers and regulators should monitor developments and carefully consider whether these regulatory tools will be necessary to harness the benefits of competition for meeting their social and economic goals.

GSR discussion paper

Big Data - Opportunity or Threat?

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 20 June 2014.

Table of Contents

Big Data - Opportunity or Threat

Authors: Mr. Andrew J Haire & Dr. Viktor Mayer-Schönberger

Executive summary

Big Data offers a new perspective on reality, and therefore will affect and shape all sectors of our economy, especially those that play a role in the capturing and/or relaying of data and information.
But Big Data's likely impact is broader than the economy; it affects how our societies make sense of the world, and decide important policy challenges, and as you will read, innovation.

This paper is divided into four parts: initially it provides some boundaries to the subject; next, the contributions that Big Data offers to society and individuals are explained; as a balance, the attention of reader is drawn to some of the inherent risks of this powerful new technological tool; and finally, it concludes with the regulatory and policy considerations that should be accounted for when crafting future policy.

We draw the reader's attention to the conclusion as an area for focus for establishing policy and the rules that will encourage the further use and benefits derived from Big Data, but to set the proper frameworks to prevent abuses, be they societal or individual.

1. The opening

Google can predict the spread of the seasonal flu from Internet search queries it receives. Airplane engine manufacturers can predict when an engine part will break before it actually does, allowing that part to be changed at a convenient time and place rather than when the airplane is in mid-flight. A startup company, *Inrix* offers a smartphone app that helps about one hundred million users every working day to drive from home to work and back, avoiding heavy traffic in real time. And a Dutch mobile phone operator discovered that changes in the signal strength of cell towers could be translated into local weather data, thus giving the operator a potentially lucrative and very comprehensive network of thousands of weather stations capturing real-time data.

All these are examples of Big Data; our ability to gain insights from large amounts of data that would not be attainable from much smaller amounts, and that in turn leads not only to higher efficiency but to innovative new products and services. Much like in other instances an increase in quantity results in a change in quality. We have seen this in the past, too. If one takes a photo of a horse galloping across the field every minute, then they are still just photos. But if one takes a photo every sixteenth of a second, and shows the resulting images in fast succession, the vast increase in the quantity of captured information translates into a new quality: film; and an industry was born. Something similar is happening with Big Data.

Big Data in essence offers a new perspective on reality, and therefore will affect and shape all sectors of our economy, especially those that play a role in the capturing and/or relaying of data and information.

But Big Data's likely impact is broader than the economy; it affects how our societies make sense of the world, and decide important policy challenges, and as you will read, innovate.

2. Setting the Stage

The world of Big Data over the past few years has rapidly evolved both in the marketplace and in the research community. As in many other areas, the rules governing Big Data has been slow to adapt. Further, *what* we think we knew just a few years back is now either changed or refined. The intent of this paper is to offer a foundation, showing what Big Data is, explaining where we've been, and looking at where ICT regulators, policy makers and other authorities, such as Competition Authorities or Data Protection Authorities, let's collectively call them *Regulatory Authorities*, have set or should set some boundaries. We hope to provide an understanding to foster a stronger appreciation both nationally and globally of the makeup of this term Big Data and the points of light that make up the discussion.

This paper is divided into four parts: initially we will give some boundaries to the subject; next, we explain the contributions that Big Data offers to society and individuals; as a balance, we would like to draw attention to some of the inherent risks of this powerful new technological tool; and finally, we will conclude with the regulatory and policy considerations that should be accounted for when crafting future policy.

More specifically, this is a paper about Big Data, and its characteristics, its history, its future and most importantly what Regulatory Authorities – as defined earlier - can and should do to meet its challenges without dampening opportunities. As regulators, what can, or should, be done to carry out your mandate of responsibilities? We remain sensitive that no two countries or economies share a common or identical governance structure to oversee the tech or media or other societal sectors, so we will treat them having a similar mandate, to keep the paper's discussion understandable. Reflexive actions by policy makers often lead to individual's protections rights, possibly at the expense of individual's opportunities. We hope to offer this discussion that will allow the reader to find that balance, taking into account the needs and character of their particular jurisdiction. We will further treat, for the purpose of this paper, the Regulatory Authority as one holding a responsibility to promote market health, growth, and opportunity, but with a role to protect those who rightfully can't protect themselves.

We will try to present enough diversity in the practicalities and uses of Big Data to offer awareness between the benefits and the risks; but place it in a context that allows for understanding where the industry has been and where it could be going.

Big Data obviously is closely connected to our ability to gather, analyze, and store data easily and relatively at a low cost. Therefore, most accept that there are two fundamental drivers why Big Data has arrived. The cost of computing (both processing and storage) has dropped, and the ease at which we communicate has risen. Add to this the vast amount of research in both academic and corporate communities to better connect what seems to be 'unrelated data' to becoming 'related'.

What is and what drives Big Data?

In computing, Moore's Law described a doubling of computing power roughly every eighteen month at constant cost. That means one can get double the performance or half the price after 1.5 years. Moore's Law has been observed for over fifty years now, and while eventually Moore's Law will hit hard physical limits sometime in the 2020s for current technologies, further paradigm breaking computing technologies are being investigated that would push these limits out much further.

Progress similar to Moore's Law can be observed with storage density and storage cost. In fact, in recent years storage cost for some digital storage media has dropped even faster than computing cost. Thus, data that cost USD150,000 to store in 1970 now costs USD0.01. As a result storing digital information is now very affordable on very fast devices.[1]

Additionally, our software tools to manage digital storage have vastly improved, providing very fast retrieval times. But that is only half the story. The other half is the rise of a whole new breed of databases over the last fifteen years or so that are capable of storing very diverse and unstructured data, rather than the highly curated and finely structured data records of the 1980s. These rather messy unstructured databases, such as Google's *MapReduce* or the open-sourced *HADOOP* are now mature, providing fast storage and easy retrieval, with over ½ of the *Fortune 50*[2] using this platform.

Taken together more often than ever before in human history we now can decide by default to keep and store data that we have collected rather than to purge it soon after collection, because storage is now affordable and data retrieval keeps huge data holdings accessible. But two more phenomena are contributing to the current data deluge. The first is vastly improving sensor technology, making it possible to render ever more aspects of human existence into data format, precisely and at low cost. Only two decades ago, capturing location (for instance through GPS receivers) was a costly affair. Today the chips are so cheap, and can be augmented with other location technologies for vastly improved accuracy. And users are embracing this newfound capacity. The chart above demonstrates that three quarters of smartphone owners get directions from their phone – thereby agreeing to indicate where they are[3]. But a far fewer subset of that group use a service to find their friends.

[1] Pingdom.com. February 2010, http://royal.pingdom.com/2010/02/18/amazing-facts-and-figures-about-the-evolution-of-hard-disk-drives/

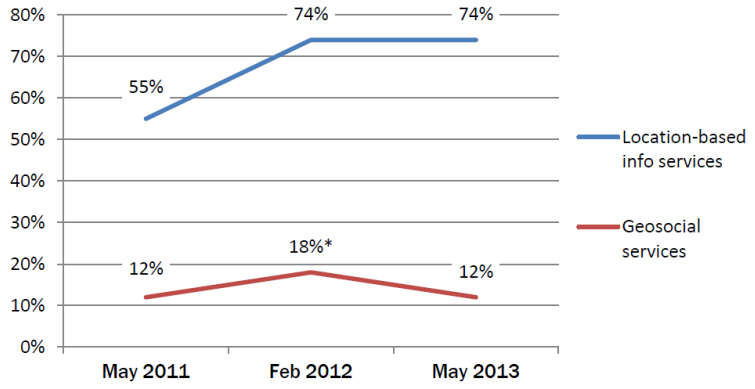
[2] PR Newswire; Altior's AltraSTAR – Hadoop Storage Accelerator…, 18 Dec 2012. Retrieved 1 May 14.

[3] http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_Location-based%20services%202013.pdf

Use of location-based information and geosocial services among smartphone owners, 2011-2013

For location services: % of smartphone owners who use their phone to get directions, recommendations, or other information related to a location where they happen to be.

For geosocial services: % of smartphone owners who use a service such as Foursquare or Gowalla to "check in" to certain locations or share their location with friends.



* Slight wording change since previous survey

Source: Pew Research Center's Internet & American Life Project tracking surveys. For 2011 data, n=2,277 adults ages 18 and older. For 2012, n=2,253 adults. For 2013, n=2,252 adults. All surveys were conducted via landline and cell phone, in English and Spanish.

Sensors are now also available for everything from movement and acceleration to environmental aspects (temperature, atmospheric pressure, UV exposure), to the now booming field of health (heart rate, blood oxygenation, even blood sugar levels). To demonstrate versatility, in the mid-2000s sensors were placed on experimental basketballs to calculate spin, location and trajectory – and more importantly, would the shot 'go in', and if not, why not. Soon sensors will go even further, capturing aspects such as smell with far greater precision than today. Other sensors capture vibration, weight, distention and many other aspects of physical properties.

The most versatile sensors, so to speak, of course are humans themselves. Revealing data about them or even more importantly about others on social networking sites, through fitness, health and quantified-self data platforms account for another substantial portion of increased data streams available.

While much of the data we create we believe is evident and even viewable (we write an email and we see the results), we also leave behind our transparent fingerprints everywhere we go. We have a phone that knows our movements, but what about the surveillance camera that image-identifies us; the airport scanner that knows what we travel with; the credit card that knows our eating habits down to the food we like? Our cars know where we drive, when we drive, and how fast; our library card knows what we read and view; our health monitor (if we choose to own one) knows where and when we walk, run, cycle – and even what our heart rate is. And all of this data can be saved, stored, communicated and under some circumstances, shared. In sum, this data where you've been, where you are, and now where you might be going, is being collected at rates faster than ever before.

In a novel experiment, and subsequent research paper[4] three members of the Computer Science Department at the University of Rochester, (New York, USA) explored the relationship between people's location, their interactions and their social ties through a social network. Amazingly, even if you deliberately created your online-self as "dark" – making yourself private and invisible – this analytical approach (referred in their work as 'Flap') would be able to predict your physical location within 100 meters with an accuracy of 47 percent.

As mentioned above, the second phenomenon that contributes is networking speed and reach. Data bandwidth is continuously increasing by leaps and bounds throughout the world, both in wired and

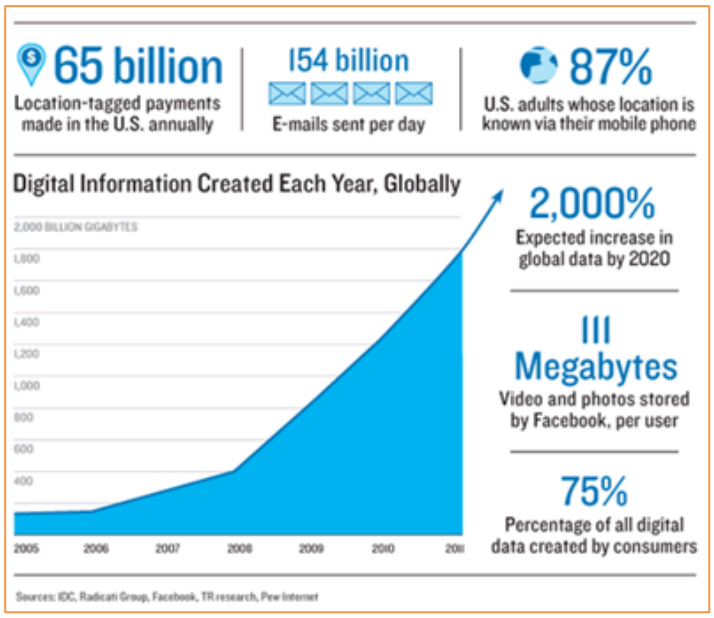
[4] Adam Sadilek, Henry Kautz and Jeffrey Bingham, "Finding Your Friends and Following Them to Where You Are", 5th ACM Conference on Web Search and Data Mining, 2012

wireless networks. LTE wireless networks rolled out in many large metropolitan areas around the globe provide what used to be broadband speeds available to wired networks only a few years ago. Moreover, relatively recent backbone and undersea cable activity has connected geographic areas around the world to the Internet that have long been underserved. East Africa is a particularly salient case in point here. As networks become more powerful, and reach further, more and more data can be shared, exchanged, but more importantly combined and analyzed together to further advance Big Data insights.

How much and how fast is the data in the world growing?

The best "guestimates" of the total amount of data in the world suggest that from 1987 to 2007 the total amount of analog and digital data in the world grew from 3 billion gigabytes to 300 billion gigabytes, a 100x increase in two decades.[5] In research by Cisco, the computer manufacturer has added color to the profound scope of the data that exists and is being created.[6]

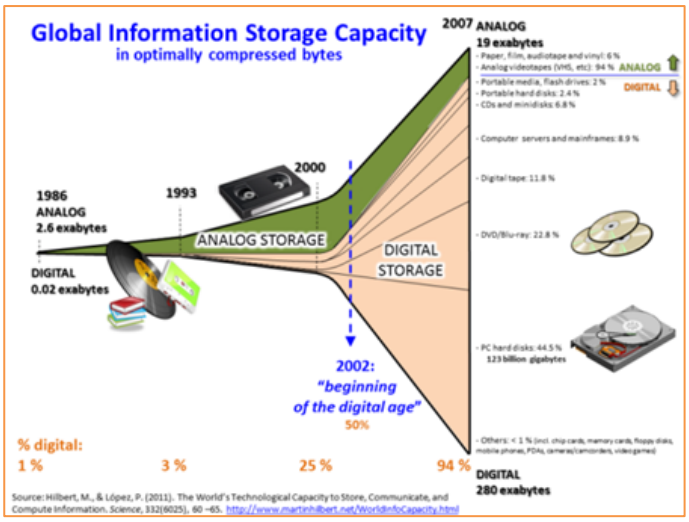
Many of these statistics have found their way into discussions over the past few years, but none is more telling that ninety percent of the world's data has been created in the past two years.



[5] Martin Hilbert and Priscilla López, "The world's Technological Capacity to Store, Communicate, and Compute information." *Science* 1 (April 2011), pp. 60–65

[6] Cisco. Cisco Visual Networking Index; http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.pdf

There is another shift taking place. Data that was in the past stored in an analogue format and not necessarily ready for analytics, is now in digital form, and this creates huge opportunities for analysis, indexing, mining. Voice, video and other visual content can be more efficiently diagnosed and analyzed and indexed for mining and identification with the other digital indices and of kept data. Historically this analogue medium grew slowly, held a relatively short shelf life, aged quickly, and provided an infrequent means to connect with existing digital data. The common and familiar storage formats were tape cassettes, vinyl records, and celluloid film. Sound was (and to a degree still is) analogue. Today, sound and images – Skype and YouTube, to name just two - are digitized before they are transmitted. But this all is changing. In the year 2000, three quarters of data had been analog, now more than 99 percent of data in the world is digital.



Data growth has been accelerating recently. More than 90 percent of all data that exists was created in the last two years.[7] IDC, a research firm, predicts that there will be 44 times more digital data by the end of 2020 that there was in 2009 - or put differently - the amount of digital data doubles every 20 months. It is not just people that are creating data. A Boeing 777 airplane generates a terabyte of data during a three hour flight; and after 20 such flights it has generated more data than presently is in the world's largest library, and as technology improves the aircraft will be capable of capturing up to 30 terabytes from its sensors[8]. Today 75% of data is created by individuals with activities such as emails, documents, downloading movies, to name a few.

Throughout the world, in a growing number of governments projects are under way to make vast troves of data collected by government publicly available so that individuals but also companies can use it. Often termed "open data" these initiatives not only aim to improve public as well as accountability democratic deliberation and participation through increased transparency. Governments also see "open data" as a non-monetary way to incentivize and facilitate big data entrepreneurship and innovation. It is a "data subsidy" instead of the more traditional (and much more costly) monetary subsidy and has led to literally thousands of applications around the globe.

Additionally, the World Wide Web Foundation (www.webfoundation.org), based in Switzerland is fostering engagements with stakeholders to further develop Open Government Data (OGD) initiatives in low and middle income countries. The intent of these initiatives are to improve transparency and accountability, and by do so increase the efficiency and effectiveness of government.

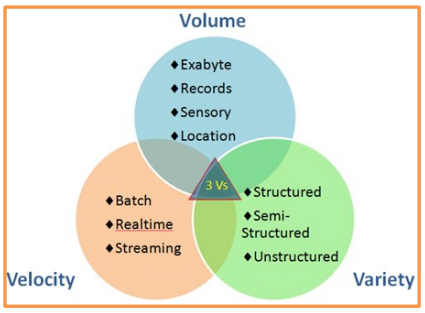
Particularly Internet companies are drowning in data. Over one hundred million photos for instance are uploaded to Facebook every single hour, much like an hour of video on YouTube every second. And Google is said to process well over a petabyte of data every single day – that is the entire amount of all data stored in the largest library of the world, the US Library of Congress, one hundred times over.

Big Data's defining qualities

[7] SINTEF. "Big Data, for better or worse: 90% of world's data generated over last two years." ScienceDaily. ScienceDaily, 22 May 2013. <www.sciencedaily.com/releases/2013/05/130522085217.htm>.

[8] Rosenbush, Steve. The Wall Street Journal, CIO Journal. 13 November 2013.

So it is tempting to look at this deluge of data that is accelerating and think of it, and its drivers as capturing and being the essence of Big Data. Research firms and other corporate stakeholders, such as Gartner, McKinsey and IBM, and institutions such as the ITU have put forwards a plentitude of acronyms and labels to encapsulate the Big Data qualities, such as the often used three Vs, of (high) volume, (high) velocity, and (high) variety. There is a fourth V offered: veracity – or simply the believability of the data itself. We would also like to draw attention to the ITU's Technology Watch Report (November) 2013 that further address the meaning and uses of Big Data. But we believe that the definition here lends itself to a more qualified definition, if for no other reason than the Big Data landscape has evolved so dramatically recently, so this will be explored further below.



But we suggest that these terms fail to capture what Big Data is really all about. To understand Big Data, we need to understand how humans have made sense of the world so far. For millennia we have done so by observing the world, and gaining insights from our observations. For hundreds of years, we have systematically captured data, and evaluated it to reveal ever more details about reality. But capturing data always had been extraordinarily costly and difficult, and so was analyzing and storing data.

So to save cost and time, humans have devised methods and mechanisms, institutions and processes to answer questions by collecting and analyzing as little data as was absolutely necessary to do so. Because of cost, we chose to live and think in a world of Small Data – and we understand reality based on this constraint.

If the constraint of capturing, analyzing and storing data goes away, we can rethink our deeply rooted traditions of how we make sense of the world around us. This is what Big Data is all about: it is a new lens on reality, capturing not just a simplified version of it that gave us a first (but often blurry) glimpse, but a detailed version that captures and illuminates reality comprehensively and in its full complexity.

Hence, the defining qualities of Big Data are deeper and more profound than what often is suggested. The three terms that capture this are: *more, messy and correlations*.

- **More**: This means that we can now capture and analyse more data *relative* to the phenomenon we want to understand, the question we want to answer than before when we relied on small samples and subsets of data. That way we can look into details with unprecedented clarity, and even more importantly we can answer questions that we did not even think of when we collected the data (which is often impossible when just relying on a data sample). This is what experts mean when the say that we can now "let the data speak". So what counts is not the absolute number of data points (the "volume"), but the relative number of data points that captures and let's see reality as it is.
- **Messy**: In the times of Small Data, we spent a lot of effort ensuring that the limited number of data points we cared to capture and analyse were of high quality. That is understandable. If you only have 100 data points, getting 20 of them wrong will skew the result, leading to bad consequences, what is sometimes called GIGO – "garbage in, garbage out". But in the age of Big Data our ability to capture many magnitudes more of data, will make it more cost-effective to go for more data even if the data is of varying quality than to expend great cost at capturing little data at high quality. It is not that we give up on exactitude entirely; it is only that we give up our singular devotion to it. What we possibly lose on the micro level, we gain in insight at the macro level.
- **Correlations**: Humans always thrive to find causes for what they observe and experience. This comforts us and gives us the sense that we understand the world. But often the causes we identify are simply wrong. Statisticians have long made the point that with most statistical analysis we are not able to tease out causalities, but correlations – seeming connections within

the data. Correlations do not tell us why things are happening, but they tell us what is happening, and that already can be an important insight.

For instance, large retailer Wal-Mart through a Big Data analysis of transaction data discovered that before a hurricane, people buy batteries and flashlights, as one would expect. But they also discovered through correlational analysis that people bought Pop Tarts, a sugary snack. For Wal-Mart it does not matter why people buy Pop Tarts – but it is very valuable to know that people are buying Pop tarts before a storm. That way, Pop Tarts can be moved to a more prominent location in the store, and more of them are sold. Similarly Amazon does not know why certain people buy certain products together with others, but know that they buy such products drives Amazon's product recommendation engine, and is said to be responsible for about 35 percent of Amazon's revenues.[9]

This does not make the quest for causal linkages superfluous, but it strongly implies that rather than venturing into often incorrect assumptions and suggestions of "why", we are better advised to use correlational analysis to first understand *what* is going on. That in it may sometimes be good enough, full of valuable insights that drives innovation. But it also acts as a powerful filter to highlight what specific correlations we may want to investigate further to understand the underlying causes, making such explorations far more cost-effective than ever before.

Taken together, more and messy data, analyzed often first through identifying correlations gives us a very unique, very powerful, and comprehensive lens into reality, and thus let's make predictions about the present and the future. In short, this is what at its core Big Data is all about.

Derived from these defining qualities of Big Data, and in line with the drivers at play that enable Big Data as outlined above, the core economic principle of Big Data comes into focus. It is not that data can provide insights – humans have known that for millennia. It is that as we move from an age of Small Data to an age of Big Data, what we do with data and how we extract value, especially economic value from it changes.

In the Small Data age, not only was relatively little data collected, but it was gathered with a specific purpose in mind. Once the purpose was fulfilled, the data had achieved its value, and often was put aside, forgotten, or at times even actively purged because of high storage cost.

In the age of Big Data the value of data is not exhausted by applying the data to the purpose for which the data was collected. Rather the value of data is the sum of the many uses and reuses the data can be put to that might not have been obvious at the time of collection, but turn out to reveal insights that are worth a lot.

Eight Principles

This has huge consequences on how commercial entities collect, analyze and store data, which can be summarized in these eight general principles:

- **Data Retention**: In the Big Data age it makes sense to store data much after it has fulfilled its original purpose, because it might still hold value that can be extracted by reusing it for novel purposes. For instance, *Google* looks at old search queries to learn what mistakes people make when typing words, and thus is able to correct these mistakes automatically, leading to what arguably is the world's best spell checker.
- **Data Collection**: In the Big Data age, it may make sense for commercial entities positioned at the flow of data to capture and store that data even if it cannot be used for a particular purpose yet as the data may hold dormant value. As an example, *Facebook* is saving years and years of user input because that data holds latent value even though currently *Facebook* dos not fully extract that value.

[9] Matt Marshall, Aggregate Knowledge raises $5m from Kleiner, on a roll; VB News, December 10, 2006.

- **Data Primacy**: It is data that holds value, and so those that have data or have access to it will be able to extract that value, while those that do not have data will suffer economically. This is the real meaning of the shorthand that data is the "new gold" or "new oil". That analogy is actually insufficient, as unlike physical resources such as gold or oil, the potent value claim with data is that its value is not exhausted by being used once. Unlike physical resources it can be recycled many, many times over and still provide value.
- **Data Expertise**: The expertise to extract the hidden value in data is very important for commercial entities, and currently there is a shortage of experts in this field. These data scientists are therefore in high demand and are able to command high salaries. Eventually however this will change as the labour markets adjust to this demand by creating an increasing supply of data scientists, much as they did in the past with telecom experts, software programmers, network engineers, or web designers.
- **Data Mindset**: More important arguably than the technical expertise in analyzing big data sets is the strategic ability to see value in specific data, and to be focused on exploiting that. This is one of the reasons why a small (but growing) cadre of Big Data entrepreneurs has had serial successes in Big Data start-ups entering even relatively crowded market spaces. Professor Oren Etzioni, who founded travel price forecaster *Farecast* and consumer goods forecaster *decide.com* is an excellent example.
- **Non-linear Scalability of Data**: Because data's value increases with the possible connections between data points, having more data will disproportionally increase data's value. It is Big Data's network effect, and it means that scale efficiencies are neither linear nor step-linear, but following a power law. More data means much more value. This will drive many large Big Data companies to become even larger data holders.
- **Reduced Barriers to Entry**: At the same token, a Big Data start-up does not have to invest heavily in technical infrastructure to process and store data. Unlike in the previous generation of start-ups, such as Facebook and Google, Big Data start-ups can utilize cloud storage and cloud processing capacity that provides them with flexible commodity priced capabilities when they need it. This greatly reduces the barriers to entry, and creates strong incentives for companies and entrepreneurs to begin utilizing Big Data. So while the big may become bigger, the small and nimble retain a very strong proposition to succeed.
- **Data's Utility**: The utility of data will be irrespective of the economic sector the data's holder is operating in. So for instance, a telecom operator might find it to be a weather data platform, or a car manufacturer may turn itself into a data platform for mobility and travel. This means that companies with traditional revenue streams and in established sectors may both find themselves capable through their ability to capture and analyse data to enter other sectors and add new revenue streams, as well as also find themselves competing against new entrants or those from completely other sectors.

Improving efficiency is of course very important for any economic player, and particularly important for players in sectors that offer largely commoditized products, such as in telecommunications. Lowering the cost of production of a product or service is essential, as businesses in these sectors struggle to stay profitable.

It is obvious and understandable given the powerful nature of Big Data that the initial focus of Big Data on businesses and business models has been its impact on efficiency. For instance, a quick glance of applications that a major computer company, IBM, is tackling emphasizes efficiency:

Figure 1: Enterprise applications with a focus on Big Data

Source: IBM

An efficiency strategy alone, however, is not going to be a long-term solution, as efficiencies only give relative advantages vis-à-vis the competition, but are not creating new revenue streams (and thus business value) themselves. Fortunately, the real power and role of Big Data is not limited to enhancing efficiencies. In fact, it goes far beyond that. Big Data creates new insights that will enable new products and services. Big Data is, perhaps more than anything else, a tool for innovation. The role of data thus changes, from an auxiliary function of enabling efficient transactions to becoming itself valuable, and thus turning into a source of revenue and profit. This we will explore further in the following section.

3. The opportunities

Big Data offers a great number of opportunities, which we canvass in this section. Depending on who is benefitting primarily from these opportunities, we have this section divided in thirds: a section for opportunities in the enterprise, for opportunities for the individual and opportunities for society at large.

For the enterprise

McKinsey & Company, a consultancy, reported[10] that "Big Data" generates significant financial value across: US health care; EU public sector administration; Personal location data; Retail productivity; Manufacturing. This report spells out that enterprises need to prepare for what is coming; not just go along for a ride. Their findings followed with: data has swept into the industry landscape and it has become as important as capital and labor; ways exist to have data create value (transparency; more drives accuracy; more gives greater segmentation; improved decision making; product development); it will become the competitive edge – more in some sectors than others; use will provide productivity and efficiency; there will be a shortage of talent.

Further research by MGI and McKinsey had outlined where to uncover or unlock data within an organization that could transform into value. The interactive website[11] effectively shows where expertise has been 'invested' based on industry and role. The key point remains that the skill to leverage and then interpret this data is in short supply.

[10] McKinsey Global Institute; http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation p8.

[11] http://www.mckinsey.com/tools/Wrappers/Wrapper.aspx?sid={EA4CDB7F-4500-49DE-B5FB-CD35AA13806D}&pid={A30FD727-0384-4CF1-9364-4C17E9ADB9F8}

Human Resource functions. In another example, and based on an article in the SHRM's publication[12] Human Resource responsibilities from training to integrating a newly acquired company can see potential from the analytics of Big Data. HR activity has always been data-driven but with the dawn of vast amounts of additional data arriving from social media, analytics, smartphones the HR role is challenged with using this data effectively and at the same time respecting the personal and private nature – and in some cases contextual nature - of its content. Many firms now use analytics in prescreening applicants for new positions, and the simple wording chosen for a CV makes the difference between 'filed for the future' and the next round of interviews.

Telecommunications companies have not only vast amounts of operational and customer data but hold a reach insofar as their networks are local, regional and global. One firm discovered that a variation in radio frequency transmissions at mobile base stations - data already received - preceded weather changes, and became a good predictor of pending weather. Much has been made of mobile providers sharing high concentrations of their users at, say a public sporting event, to alert transport and public safety authorities of pending congestion, but in some cases anticipating where that congestion happen (which road, what form of public transport). With Big Data we can predict with a strong degree of accuracy the who will be using public transport, but where they will be going – thus allowing for a smooth degree of capacity planning. In another area of extending the usefulness of networks, undersea cable systems are built with extensive monitoring equipment to detect seismic activity. Given that scientists believe seismic waves are the most powerful tool to study the earth structure, and that 2/3 of the earth's surface is covered by ocean, these systems make a strong tool to complement study and hopefully improve prediction of future earthquake activity.

Changes to business models.

Advertising, as we once knew it, is dead. The approach of repeatedly showing images and pictures to consumers to reinforce or sell a brand is gone – probably forever. In its place are methods are highly targeted messages, friends recommendations, search analysis that result in a profoundly more efficient and effect way to reach the exact consumer the company CEO's complained that there was no clear connection between ad spending and the resulting sales; often thinking that the former was highly inefficient. Many believed that better places existed to invest their precious capital. Once that 'clicks' replaced TV viewing surveys about two decades ago, the CEOs started to gain the precision they so desperately wanted. Tools like Google *AdSense* and other integrated advertising platforms followed you from site to site, as you browsed the web – they not only know what your interests, but can observe how long you remain engaged – thus showing desire.

Recently the *New York Times*[13] printed an article on a Facebook experiment to answer a vexing question that has swirled around the US for over a century: "which is your favorite baseball team", or put differently: "where are the fans". Of course the issue is not cosmic, but it showed the power and precision of Big Data.

This is a classic consumer research question, but in the past a survey might have tried to gain insights from several thousand people, but this particular study it reached many millions of followers, allowing a far more significant degree of accuracy. To the street or even the postcode, the loyalties of were now known, but what was more valuable it showed which team was the 2nd, 3rd, 4th, etc. followed. The owner of a team knows exactly where fans are, and more importantly aren't. More importantly, it knows gender, age, buying habits, and viewing habits – it also knows if these habits are changing. You need not waste your advertising budget to reach possible fans who are already are your fans. The difference between the old and the new is accuracy, primarily from the size of the sample, and the ease as which someone can identify what they like and don't like.

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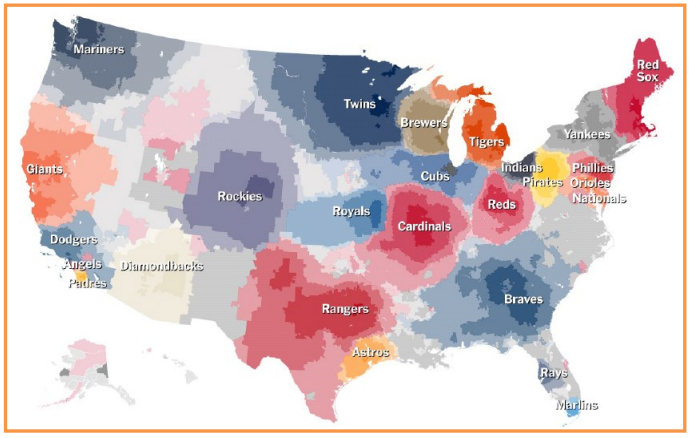
[12] Bill Roberts; Society for Human Resource Management; Vol 58, No 10. 1 October 2013; http://www.shrm.org/Publications/hrmagazine/EditorialContent/2013/1013/Pages/1013-big-data.aspx

[13] New York Times, Up Close on Baseball's Borders, 24 April 2014; http://www.nytimes.com/interactive/2014/04/23/upshot/24-upshot-baseball.html

The map on the right[14], the darker shading is deeper fan interest, is available with its deep precision and accuracy on the internet to anyone who is so inclined to take a look.



For the individual; as a consumer; as a citizen

More to store and save. Individuals, too, benefit from Big Data. For instance, more efficient production of goods or services will enable companies to compete more successfully in the marketplace, including on price. This will enable individuals to get the same service at lower price, or quantitatively more at the same price (or some combination thereof). One example of this is the continuously increasing size of free email inboxes with large free email providers. Google for instance now offers 15 GB of free space to individuals, but started out with just 1 GB when it began operations in 2004.

Less road traffic. One of the easiest and in some cases powerful platforms for Big Data is to have individuals become the real-time source of data; something referred to as crowd sourcing. One such company, known as *Waze* (www.waze.com), offers individuals a clear and quick path to avoid heavy traffic. After informing *Waze* of your destination it routes you based on the known speed of others on the same route using the app. The others supply continuous driving speed for the road selected for dynamic routing for you, and re-routing if need be. One of the many clever side-benefits arrives when users warn of heavy traffic, a disabled car, or even hidden police traps – all of which will be broadcast to others using the app as they approach the area.

A small example: ever wonder how your supermarket offers coupons to you on items you have not bought today, but might be of interest? If you belong to the markets loyalty club, they know your buying habits (history), they know what you bought today (checkout), they may even know their overstock (inventory), and they know your location in their store. Bring the four together, and in real time offer you that coupon as you push your cart down the aisle past what they want you to buy.

As Big Data facilitates innovation, and thus new products and services to be developed and deployed, individuals benefit from new as well as improved products and services. In short: consumers benefit from innovation fueled by Big Data.

In medicine.

We have touched on the point that the value of data increases when more data is collected. This phenomenon is becoming quite evident in the field of medical care. The challenge lies with the tension that personal medical information is often viewed as quite private and personal, but the societal value of sharing information collectively is enormous. Medical researchers are continually looking for statistical significance in their work – but are blocked by achieving consent from the individual, so the costs of each data point remain high (often exceeding USD200 for each point). This then leverages the cost to develop medication or even medical procedures in the millions and sometimes billions of US dollars.

There should be strong incentives, mostly through public awareness and direct participation, that sharing of medical history, under controlled circumstances can yield significant public gains. In a report by the World Economic Forum it was demonstrated that by engaging individuals in a trusted way that significant improvements were achieved among the population: an 18% increase in the control of diabetes; a 20%

[14] New York Times. 24 April 2014. http://www.nytimes.com/interactive/2014/04/23/upshot/24-upshot-baseball.html

increase in the control of cholesterol and a marked difference in clinical outcomes in hospital performance where its data was published and shared.

SARS. Some may recall in 2003 the unknown nature of both the SARS infection and how it spread. With this uncertainty the public in infected areas became obsessed by avoiding contact with anyone. In addition to the tragic consequences associated with SARS, it had far reaching economic devastation. Faced with the prospect of an early symptom, the public had little choice but to precisely retrace where they recently had been, and more importantly, who they were in contact with – no easy task if you walked on a crowded street. Quarantines were often put in place for no other reason that a suspected infected person may have visited or walked nearby. Workplaces were deserted; commerce came to a halt. Special contact centers were established to provide a clearing house to find others you may have come in contact with.

Big Data, as we are starting to know now could now play a very useful role in tracking the movements of infected persons, and permitting society at large to be far better informed, and hopefully less alarmed, than a decade ago.

Research. In another area where medical research can be improved is with pediatric medicine[15]. Presently in pediatric intensive care units in hospitals measurements of patients is relatively limited, both in what is recorded and how often it is recorded. Under a significant research project in Southern California in the U.S., work is being done to greatly expand the data points using sensors on the children. A major part of this project is to start 'mining' archived pediatric data with real-time data hopefully allowing doctors access to far better analytical research, leading to improved predictive medicine for patients needing rapid diagnosis.

For society

Climate Change. Today, one of the pressing global issues (and debates) is global climate change. The data collected in not only the historic facts about our earth – temperatures of air and sea, currents, - but present day observations from weather stations throughout the world. While there isn't agreement about the future of climate changes, there is almost universal agreement that it is caused by mankind – which of course means changes, even small ones, for the good might remain in man's control. The analytical models to predict change depend heavily on Big Data, and the sharing of this data. Scientists, unlike Mr. Maury, will need to rely that this data, no matter where and how collected, remains available in an unrestricted form. Advancements in science depend on this sharing.

Education. Online learning has been available for quite some time. In the last five years substantial research and application has taken this platform to a wider and broader level. Two computer science professors from Stanford (a U.S. university), Andrew Ng and Daphne Koller founded a for-profit company offering what is called, massive open online courses – or MOOCs[16]. The departure with this company is that courses are provided at no charge, the material is of a world class nature, and the number of students that have taken courses is measured in the hundreds of thousands – and each course contains video lectures, exercises, and occasional quizzes. The courses are offered over a 6-10 week period, but each course has been designed to insure the student interacts with the material, not the traditional approach - the other way around. Keystroke biometrics is used to check the identities of enrolled students – and the effectiveness of learning the material. Peers grade homework - and statistical methods are used to complete that student's assessment; so the most important byproduct – this given a unique view into human learning given and that the sample size is so large - is higher quality education.

Crime Prevention. Predictive technologies associated with Big Data are starting to play a significant role in determining an individual's propensity to commit a crime. Errors are costly, and in some cases illegal by civil authorities. The U.S. cities of Memphis and Los Angeles are 'experimenting' with technologies

[15] Phys.org, October 22, 2012, "Using Big Data to Save Lives", http://phys.org/news/2012-10-big.html

[16] TED; June 2012; http://www.ted.com/talks/daphne_koller_what_we_re_learning_from_online_education

that can determine crime 'hot spots' before they become 'hot'. Richmond, Virginia, used software to analyze crime patterns, in one case the sensor reporting of random gunfire a few hours before and after midnight on New Year's Eve. The result allowed public safety officials to find and confiscate a disproportionate number of unlicensed firearms; which resulted in removing street guns, which in turn resulted in fewer gun related offences, meaning fewer police officers necessary.

Legal side-effects. The use of new technology, be it sensors – some undetectable, GPS trackers, CCTV image scans, will start to figure in litigation, especially the question of the individual's legitimate expectation over his/her privacy. This will test the boundaries of the present evidentiary process.

Altered perceptions. Authorities often face the dilemma of having to render important policy decisions with very limited data. The results are not just ill fated public sector projects and initiatives, but a general distrust in government and the public sector. Fewer people believe government has the capacity to tackle complex policy challenges.

The opportunity beckoning with Big Data is that not only empirical data can be gathered, but so much data can be gathered that we can see how society as a whole behaves in real-time, we can watch how societal dynamics unfold at scale.

For instance, the public sector in the UK working with Big Data startup *Inrix* reuses navigation and traffic data gleaned from a large number of drivers to see commuter traffic patterns around London, and to retune their planned extensions of public transport and Park&Ride facilities. Or the Centers for Disease Control in the US have worked with Google to better understand the spread of the flu in close to real time using search queries sent to Google. Or a startup company of economists building on a research project developed at MIT capture billions of prices from eCommerce companies every day to predict in close to real time changes in consumer prices, and thus inflationary effects. So good (and objective) are their results that the Economist uses their measure instead of the official inflation rate for Argentina.

Much more is possible, and if employed correctly could greatly aid and inform public sector decision-making, and thus improve government and benefit all of us in society.

4. Outcomes with Concern

Unfortunately, but perhaps unsurprisingly there are dark sides to such a dramatic increase in the collection and storage of data, including personal data. The most obvious among them is that Big Data will result in a comprehensive infrastructure of surveillance against which even Orwell's dystopia "1984" pales in comparison.

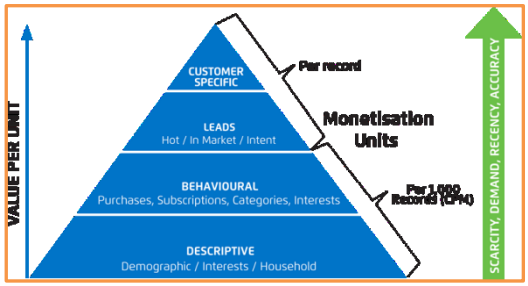
Are you for sale? If you use your handphone, social media, subscribe to almost anything, pay with a credit card, or put another way, live in the 21st century you are creating substantial personal data about yourself. Where might this data end up? While the brands of service providers such as Verizon or AT&T may be familiar to US consumers there is a very large company, Acxiom which may not be. Acxiom collects information on about ½ a billion people around the world, and have about 1,500 data points on their behavior – or put differently about 6 billion data points available to their clients.[17] While most telecom companies globally can't sell individual information without running afoul of privacy protections, they can aggregate a grouping of individual information or delete personal identifiers from records, believing that this "anonymization" has removed the personal individuality from the data.

Source : New York Times

[17] Tucker, Patrick. The Naked Future, 2014, Current. Page 119.

This practice caught the eye of American legislators about a year ago, and during a hearing before the U.S. Congress an Acxiom executive agreed to make information his company sells reviewable to the individual whose information it was. It further agreed to allow that individual to 'opt out' from having private information shared; but led the CEO to share[18] that if 20% opts out, it "would devastate our business". That alone speaks volumes about the business model of individual's surveillance. In response to these promises a website was created (AboutTheData.com) which allows a look at what they have about you.

Its value. The value of your personal information sold by marketing firms like Acxiom is directly related to how specific it can be about you. Simply they will not be able to monetize it until they collect substantial data points about you – it is far more important to know that. Herein lies the marketer's incentive – maximize the data on the individual. This creates a policy collision with the privacy rights advocates. The chart on the right demonstrates this pressure.



Not only large data brokers like Acxiom that have created a huge system of ingesting, storing and keeping ready for retrieval detailed data for hundreds of millions of people around the world, but many large global brick-and-mortar businesses, such as Wal-Mart, Target and Amazon, have done similarly for their customers. And while some of them only slowly are awakening to the commercial benefits of Big Data, once they do, they may turn into formidable powers of surveillance.

Internet companies, as one would expect, have kept personal data of their users and customers for years. Amazon is said to have captured every buying transaction, even every product a customer looked at but did not buy since its early days in the 1990s. Google is said to have kept and stored every single search query it ever received (plus data to identify from whom it came). Google receives almost a half a billion such requests every single day.[19] And Facebook is said to hold in storage well over one thousand billion data points of its one billion users; more than a half a petabyte of new data arrives at Facebook each day[20] (50 times more than the world's largest library). Parenthetically, it is reported that there is US$4 billion in potential sales abandoned each year in online shopping carts; thus creating a huge future marketing opportunity to re-mine the data – 63% of that by some estimates[21] – a value larger than the entire economy of a small country.

In addition to commercial entities, government agencies, too, are amassing huge piles of personal data, as the revelations of Edward Snowden revealed in 2013. And through data retention laws targeted at telecommunication companies, combined with sometimes opaque mechanisms, even more personal data is collected and held in storage which government agencies are able to access.

How open is a website? If you ever care to question the degree with which a website shares your information, check out PrivacyScore.com (http://privacyscore.com/). This analytic provides a score 0 to 100 showing the degree that you will be tracked and the extent that they will share your information.

Anonymization. In recent years there has been much effort to define policies to anonymize personal data. It is largely believed that these efforts will not work, mostly because we are now capturing more data, and we have stronger tools to combine and connect data. Two much publicized cases one involving Netflix, a US movie rental service, and the other, AOL[22] showed that with even basic technology someone

[18] Natasha Singer, "A Data Broker offers a Peek Behind the Curtain", New York Times, 31 August 2013.

[19] Craig Smith. DMR, 2 February 2014. By the numbers: 40 amazing Google Search Statistics and Facts.

[20] Facebook; Under the Hood, 8 November 2012; www.facebook.com/notes/facebook-engineering/under-the-hood-scheduling-mapreduce-jobs-more-efficiently-with-corona/10151142560538920

[21] Smith, Cooper. Business Insider; "Shopping Cart Abandonment…", 15May2014. http://www.businessinsider.com/heres-how-retailers-can-reduce-shopping-cart-abandonment-and-recoup-billions-of-dollars-in-lost-sales-2014-4

[22] Mayer-Schönberger, Viktor and Cukier, Kenneth. Big Data: A Revolution That Will Transform How We Live, Work, and Think (HMH, 2013)

could re- anonymize data that these providers were convinced otherwise. Professor Paul Ohm, of the University of Colorado Law School (in the US) and expert on the harm done by de-anonymization explains in an article published in the UCLA Law Review[23] that no easy fix is available – and even arrives at the point that given enough data, no anonymization is possible because any connection makes those of us seeking anonymity an unrealistic objective. In the era of Big Data the three core strategies to insure privacy – individual notice and consent, opting out, anonymization – have lost much of their effectiveness. As mentioned earlier in this paper, researchers at the University of Rochester can identify those who chose to be 'dark' online only to 50 percent accuracy.

Given plummeting collection and storage costs, this tendency to surveil and store the captured data will likely only increase in the years to come.

A New Dark Side

But in addition to surveillance a new dark side looms, and one that so far often overlooked. This is the tempting possibility to employ big data to predict the future of an individual and hold that individual accountable for that predicted behavior. It is the idea that humans are being punished not for what they have done, but for what are only predicted to do. This may sound futuristic, and indeed is the main plot line of the 2002 Hollywood blockbuster "*Minority Report*". But it is far more science than fiction. For instance, in more than half of US states, parole boards deciding whether an incarcerated criminal should be freed on parole are utilizing Big Data analysis that portends to predict the likelihood of that criminal to be involved in a homicide in the next twelve months[24]. Dozens of police forces in US cities and metropolitan areas use "predictive policing", a Big Data analysis that forecasts when and where the next crime will be committed.

Not only government agencies employ Big Data predictions to make decisions over whom to control and to punish, commercial entities, too, use probabilistic predictions sometimes to assign individual responsibility irrespective of actual behavior. For instance, car insurers in some countries charge drivers who had bad grades in school more than those that did well in school (their prediction says that people with bad grades in schools are comparatively lousy drivers). Similarly, some people are denied loans and credit not for what they have done, but what a Big Data analysis predicts they will do (namely to default on their loan payments), even though they have never missed a payment in their past. Such behavior may be risk optimizing for the commercial entity employing it, but for the individuals affected it feels like punishment for something they have yet to do.

Society, too, is not immune to abusing Big Data in this fashion. In a world of wide-spread genetic sequencing, one can easily foresee societal pressure on individuals with genetic defects to eat or live differently, so that they minimize their chances of getting sick far into the future.

While the goals of prevention may be laudable, such a use of Big Data in effect will deny individuals human volition, their ability to act freely. If we were to accept the widespread use of probabilistic predictions for the assignment of individual responsibility we would surrender perhaps the most central individual freedom to collective fiat. It would be a different world, in which free will and individual responsibility has been marginalized (after all, if Big Data calculates who is guilty, and thus denies humans that they can decide, we cannot hold them responsible).

It is important to keep in mind, however, that the problem here is not Big Data itself, but how probabilistic predictions from Big Data analyses are being employed. Most Big Data analyses is based on correlations, on seeing seeming connections in the data that tell us "what" is happening, but do not tell us anything about the "why", about causes. In our society based on justice and freedom, individual responsibility and punishment is irrevocably linked to causality. Only those that caused others harm can

[23] Ohm, Paul. "Broken Promises of Privacy", 57 UCLA Law Review 1701 (2010)

[24] Ibid. Mayer-Schönberger, Viktor and Cukier, Kenneth p.158. Further information: Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die (Wiley 2013)

be held responsible, for instance. Thus it is a blatant abuse of Big Data, when one takes correlational results of likely future behavior to decide who to hold responsible, to punish, or to treat negatively.

Erosion of Trust & Big Data Backlash

The success of Big Data depends on the willingness of the public, of millions and millions of individuals individually and collectively to provide often personal data to Big Data analysts. They will do so if they see a value in letting others have that data, and if they see that others are not abusing the power that derives from having all that data. In short, Big Data success depends on user and societal trust in those that gather analyze and store data.

The moment that trust is lost, users may opt for another, less data-invasive provider. We have seen this play out in the market only recently with respect to social networking platforms. Five years ago, Facebook held a commanding lead over other platforms. Then users realized that Facebook retains all of the data, and thus creates vulnerabilities – the drunken photo from the last office party, the stupid missive angrily written then posted.

Over the last two years, alternative social networking and sharing platforms, such as *Snapchat* and *Frankly* (and many others) have cropped up and are being embraced by dozens of millions of users. *Snapchat* is said to facilitate the exchange of hundreds of millions of photos among its members every week, but these photos are ephemeral – they vanish quickly and automatically. Users have deliberately chosen *Snapchat* over Facebook because they trust *Snapchat*, but they do no longer entrust Facebook with their personal data. Frankly commits to total securing of a text while it is among sender and recipients (even *Frankly* can't read it) and completely erasing the text when done.

If Big Data users continue to gather data and extract value without keeping user trust in mind, they will destroy trust, lose customers by the millions, and end up as failures. But more is at stake: if people lose trust in sharing data with Big Data companies, the entire Big Data ecosystem may be in danger. Trust is something that can be destroyed quickly, but it takes a very long time to rebuild it if at all. Look no further that what has happened to the large US retailer, Target, following its data breach late last year. The effort to restore their customer's trust had been costly and uncertain. For a side reference, a list of the 15 worst data breaches between 2001 and 2012 has been included in Annex 1. As recent headlines are calling out to very large breaches occurred in the last six months: Target, a large U.S. retailer, compromised the personal information of somewhere between 70 and 110 million of its customers; and more recently eBay's, an online e-Commerce site, personal information for about 140 million of its customers was hacked.

Thus, it is in the self-interest of Big Data companies (and government agencies) to handle personal data with responsibility and care, and to maintain and enlarge the trust users have in their handling the data. And governments and society has an interest in ensuring that the regulatory framework is in place that helps further such trust, so that Big Data can flourish without exposing unnecessarily millions to Big Data's Dark Sides.

To this end, high-level expert groups have recently produced white papers and other documents, from the World Economic Forum and the European Union to (perhaps most recently) the White House. We have earlier mentioned the ITU's Tech Watch Report that was published late last year. While the ideas and suggestions in these efforts are varied and heterogeneous, a few trend lines emerge which we will discuss in the fourth and final section of this document.

But however these trends ultimately settle into concrete regulatory policies, they will likely require compliance to new and stricter regimes, and thus increase associated cost. While this is intended to maintain and improve user trust – essential for long-term success of Big Data – many businesses may perceive these additional costs as a negative aspect of Big Data.

False confidence in Data

Connected to, but broader than these Dark Sides that affect the acceptance of Big Data analyses in our society is another potential Dark Side that clouds the vision and understanding of those that employ Big Data. This challenge is not unique to Big Data, but Big Data is especially vulnerable to it. It is the danger that we imbue results of data analysis with more meaning that it actually has, believing that we understand more parts of reality than we actually do. It leads us to false decisions that we make with false self-confidence.

For instance, after cities introduced "predictive policing" crime decreased. Bold officials were heard suggesting that this was caused by law enforcement's new Big Data tool. But as so often the data does not reflect causality, and thus does not prove (or even strongly suggest) that Big Data was the reason for the decline in crime. Similarly, in corporate settings marketing and advertising managers are often attributing sales successes to certain (Big Data) campaigns they ran, but without enough conclusive data to show this.

In the Big Data age we will see the world much more through a lens of data and empirics than ever before. Hopefully that improves decision-making. But it also increases the danger of falling prey to giving data more meaning than it deserves, and thus to succumb to the Siren's Song of the confidence over data.

The Rise of the Data Barons

Finally we must also acknowledge a Dark Side of Big Data that is not directly linked to individuals and their rights and freedoms, but to data markets and the data economy. As we have mentioned combining and adding data increases its value not linearly but exponentially. This means that large data holders have a very strong incentive to grow even larger in order to extract more of the data's intrinsic, but hidden value. Some experts fear that this may lead towards an ever-increasing concentration of data markets, stifling competition and in turn constraining innovation and destroying overall value.

For instance, Google has advanced a number of acquisitions of companies in recent years that add significantly to its ability to ingest and gather a wide variety of data. This includes its purchase of *ITA*, one of the world's leading air travel reservation systems, or *NEST*, a company that creates devices and a platform in households to collect data about living habits – heating, cooling, even if you are at home. Similarly, Facebook has bought companies in the social networking sector to add even more data troves and users to its fold.

To an extent, this trend of concentration is countered by a lively ecosystem of Big Data startups, some of which succeed by positioning themselves well in the flow of information and compete well even against the very largest of Big Data companies. Certainly the fluidity of the Big Data ecosystem, enabled by low barriers to entry, enables these startups and act as a counterforce to market concentrations. Regulators, too, such as in the US, have attached restrictions to recent acquisitions of data companies to ensure competitive data markets.

But overall it is likely that we will have to remain vigilant against the Dark Side of market concentration and data oligopolies.

In this and the previous section we explained the upsides and the downsides of Big Data, its opportunities and its challenges. The salient question of course is whether the downsides and costs will exceed the benefits attained from the use of Big Data or vice versa. Which Big Data future is going to result? Are we going to stop Big Data, forego its many benefits in return for privacy, trust and unpredictability? Or is the pendulum swinging far into the other direction, resulting in massive Big Data uses, leaving millions of people exposed and hurting, deeply distrustful of the new technology, and creating a potent and dangerous ground for neo-luddites to fight not just Big Data but modern technology more generally? How can we negotiate a path that grants us the ability to utilize Big Data, while at the same time ensuring that Big Data is used responsibly and to the benefit not just of a handful of data holders but the wider market, and in fact society at large?

There is no simple answer to this question, but in the following, final section we aim to suggest a few policy proposals that policy makers we believe ought to consider as we approach this Big Data world, especially in the field of telecommunications.

5. The Role of (and future for) Regulatory Authorities

It is clear given the powerful qualities of Big Data and the likelihood that Big Data will shape all sectors of the economy and considering its significant dark sides, that policy makers at all levels will want to play a role on influencing Big Data's trajectory. The fundamental question however is what dimensions of Big Data policy makers should focus on in particular in their regulatory efforts. In the following we suggest four such areas of regulatory involvement:

Ensure Protection

The most obvious is of course to ensure effective protection of individuals' privacy. As we have discussed above, current mechanisms of privacy protection will become increasingly ineffective in the context of Big Data. This is not only problematic because it potentially harms affected individuals; it is also detrimental to the acceptance and utilization of Big Data, because without sufficient societal trust in Big Data users, Big Data users will not be able to operate. Thus it is not just in the interest of society, but in the very interest of all responsible users of Big Data to ensure that effective mechanisms protecting privacy are in place.

What is needed is an additional and more effective protection mechanism. Recent work undertaken by a group of privacy experts from around the world point towards a regulatory mechanism that would shift the focus of privacy protection from informed consent at the point of collecting personal data to accountable and responsible uses of personal data. The core idea is that with such a mechanism in place users of personal data would have to evaluate the privacy harms and implications of a potential new use of such data and what safeguards would need to be put in place to reduce the privacy harms before this use could commence. And while this assumes that the Big Data users would have to evaluate their intended applications, incorrect evaluations and insufficient implementation of safeguards would not only lead to civil and criminal liability. The mechanism also foresees a well-resourced privacy regulator with the expertise and power to enforce such a use based privacy protection mechanism.

The advantage of such an additional mechanism are clear: privacy protection would not rely on the mystical ability of individuals to fully comprehend the complex uses of their personal data at the moment of collection; data users could not forego the implementation of stringent privacy safeguard by pointing towards rather formal "consent of the data subjects". And enforcement would not depend on individuals suing data users (which we know from practice very, very rarely if ever happens), but rely on much more powerful privacy regulatory agencies with sufficient resources and stamina to regulate and enforce even against the most powerful data users. In return, data users would be permitted to reuse personal data for novel purposes (and thus unleash the power of Big Data) as long as a comprehensive privacy assessment had shown that it would produce minimal privacy risks.

Of course, such an additional mechanism would not solve all privacy challenges related to Big Data, but we suggest that a focus on responsible and accountable data use will go a long way in addressing some of the most troubling privacy challenges created by Big Data.

Protecting Human Volition / Taming Probabilistic Predictions

Probabilistic predictions, the operational outgrowth of Big Data analyses, can be tremendously useful. They reduce uncertainty and risk in the present and the future, and thus help Big Data users and by extension society at large to better plan and prepare for the future through better decision-making in the present. At the same token probabilistic predictions also pose unique policy challenges, especially when they are used to decide who to punish or hold responsible based only on predictions. For instance, if a government would use Big Data predictions to decide exactly which individual to put under surveillance

or police heavily not because of past behavior of this individual but just because of Big Data predictions, such a policy would rightly be viewed as infringing dangerously onto human free will.

Regulatory authorities, including those intent to facilitate the use of Big Data and the growth of the data economy, are therefore well advised to put in place clear restrictions on how and for what purpose government agencies can utilize Big Data predictions. Under no circumstances can such predictions be turned into the reasons to punish people or assign individual responsibility to just forecast behavior. There must be in place a bright red line that interdicts such abuses of Big Data analysis.

Uses by government agencies as well as commercial entities of Big Data predictions of future behavior that result in negative treatment, quasi-punishment or the withholding of benefits granted to others, while not prohibited per se, must (we suggest) meet strict scrutiny. This includes providing transparency into the data analysis, as well as the guaranteed right afforded to affected individuals to disprove the prediction.

Facilitating Publicly Available Big Data Expertise

Transparency and the right to disprove predictions, as just mentioned, will only be usable for the general public, if individuals do not have to engage in confronting complex Big Data analysis themselves, but can available themselves of especially trained Big Data experts that are also obliged to help these individuals. We envision a new cadre of such experts – the "algorithmists". Specially trained, they would take vows of impartiality, confidentiality and professionalism, much like civic engineers, or doctors.

Individuals who believe they have been mistreated because of false Big Data predictions could contact algorithmists, who in turn would investigate and render a decision. They would also help individuals in disproving Big Data predictions if an individual believes such a prediction is wrong.

Algorithmists could also advise data users on how to best implement transparent, disprovable predictive decision making, and how to ensure responsibility and accountability in their Big Data predictions.

Algorithmists would have special Big Data expertise, which includes statistical and technical training, but would also be well versed in the ethical considerations at play and the legal and regulatory constraints in place.

Keeping Data Markets Fluid

So far we have focused on the role of regulatory authorities to defend and enforce the rights of the individuals in the shadow of Big Data, whether it is the right to be free from undue surveillance, unlawful use of personal data, or maltreatment based on incorrect probabilistic predictions based on Big Data analyses. But there is another, equally important dimension that is not directly related to individual rights.

As some data markets are becoming more concentrated over time, and more and more data held by fewer and fewer commercial entities, ensuring competition in the data economy becomes paramount. Otherwise Big Data may face the same fate as steel manufacturing and railways in the late nineteenth century in the US. The concentration of power of these industries in very few hands gave rise to the first effective antitrust and competition legislation in the world, and to the recognition that government plays a role in ensuring powerful, market-stifling trusts do not form, and where they have formed they are busted.

Ensuring competition in data markets can take a variety of forms. The most obvious is for data holders to be forced to let others access their data holdings under fair and reasonable terms. Such FRAND licensing (as the term of art is) has been routinely utilized in certain areas of patent protection, and shown to be effective. Moreover, the US federal government has in recent years in a number of cases already used a

FRAND[25] licensing mandate to constrain data holders power after these data holders had acquired large data sets.

The advantage of such an approach is not only that the mechanisms has already been tested and found to be effective, but that the mechanism is well known to competition authorities and thus makes it to get it employed. Moreover, such a mechanism is utilizing market competition to reduce the power of large data holders which is much preferable to more limiting restrictions or market interventions.

Some experts have gone one step further and suggested that for data markets to truly function well, one needs to put in place a legal exclusion right for data, much like we already have in place for intellectual property. Whether such a right is truly needed, and what its features and limitations would be, this paper cannot answer. It is important, however, to note these experts' opinion in this context.

6. Forums, discussions and papers

BIG – Big Data Public Private Forum

In Europe Big Data Public Private Forum (BIG) [26] is working towards the definition and implementation of a clear strategy that tackles the necessary efforts in terms of research and innovation, while also it provides a major boost for technology adoption and supporting actions for the successful implementation of the Big Data economy.

In addition each year various government and private sector entities meet to exchange their views on projects of importance in Europe. This meeting is called the European Data Forum (2014.data-forum.eu). The forum is designed to capture a larger umbrella of views by examining Open Data, Linked Data and Big Data. This year's forum included work in: open data in the transport and communications sectors in Finland; public sector information at the European Commission; the European Single Digital Market & what is required to achieve it; predicting parking supply to satisfy demand in a smart city; to name a few.

The World Economic Forum

The World Economic Forum, an international institution committed to improve the state of world through public-private cooperation, acknowledges a new approach to handle data is necessary to protect the rights and wellbeing of individuals.

One such report[27] published in 2013 carefully lays out three strong subthemes:

- From Transparency to Understanding: People need to understand how data is being collected, whether with their consent or without – through observations and tracking mechanisms given the low cost of gathering and analyzing data.
- From Passive consent to engaged Individuals: Too often the organizations collecting and using data see their role as a yes-no / on-off degree of consent. New ways are needed to allow individuals to exercise more choice and control over this data that affects their lives.
- From Black to White to Shades of Gray: the context by which data is collected and used matters significantly. How is the data used; much like money, it means little until it is used.

In order to achieve a level of trust during the flow of data at least five issues were discovered about the data: protection; accountability; empowerment; transparency and respect. There is a deep responsibility assumed for using personal data. Before the dawn of networked data, individual data was generally used

[25] A popular term for Fair, Reasonable and Non-Discriminatory terms.

[26] http://big-project.eu/

[27] WEF; Unlocking the Value of Personal Data: From Collection to Usage; http://www3.weforum.org/docs/WEF_IT_UnlockingValuePersonalData_CollectionUsage_Report_2013.pdf

once, and usually for a specific purpose. But the era of Big Data allows for analytics to reuse data to develop more value to others about that data.

In April this year, the WEF offered a report titled, *Delivering Digital Infrastructure*, Advancing the Internet Economy[28] that measurers the fast pace of technological change against the need to insure services and support infrastructure keep up. It recommends a rethink of the regulatory scope, approach and level of engagement. By scope in this age of information and speed, it recommends thinking in far broader terms – taking into account that a decision at one level impact entire economies. By approach, it touches on an oft repeated mantra; "move the ex-ante rules to ex-post, while moving the ex-post to forborne, and repeat the cycle." Finally, the report brings up the idea of level of engagement, and by that it refers to harmonization of decisions that cross national borders – specifically spectrum.

More recently the WEF released a report titled, *Risk and Responsibility in a Hyperconnected World*[29], and focuses directly on the malicious intent to disrupt or capture information (data) in both the private and public sectors.

The International Telecommunication Union

The big data approach taken by ITU so far focuses on the following areas and questions[30]. To address these increasingly important issues, reports, such as the current paper addressing the regulatory issues, are being prepared as well as workshops and dedicated sessions in ITU events.

Standardization[31]

• Which standards are required to facilitate interoperability and allow technology integration in the big data value chain?

• Which definitions, taxonomies, secure architectures and technology roadmaps need to be developed for big data analytics and technology infrastructures?

• What is the relationship between cloud computing and big data in view of security frameworks?

• Which techniques are needed for data anonymization for aggregated datasets such as mobile phone records?

• How is big data exploited in different industries; what are the specific challenges faced; and how can these challenges be addressed through international standards, e.g.,

- **Telecommunications**: A workshop on standards for telco big data will be held on 17 June 2014 at ITU's TSAG meeting.[32]
- **Healthcare**: Big data is a recurring theme in ITU's standardization activities on e-health.
- **Automotive**: ITU's symposium on the *Future Networked Car*[33] highlighted the use of data analytics to making transportation safer, more efficient and more environmentally friendly.
- **Aviation**: Following a call from Malaysia's Minister of Communications and Multimedia at WTDC'14, ITU facilitated an *Expert Dialogue on Real-time Monitoring of Flight Data, including the Black Box* on 26-27 May in Kuala Lumpur. Experts from both, the aviation and ICT sectors debated the *Need for International Standards in the Age of Cloud Computing and Big Data*,

[28] WEF; http://www3.weforum.org/docs/WEF_TC_DeliveringDigitalInfrastructure_InternetEconomy_Report_2014.pdf

[29] WEF; http://www3.weforum.org/docs/WEF_RiskResponsibility_HyperconnectedWorld_Report_2014.pdf

[30] Source: ITU Measuring the Information Society Report (2014).

[31] For further information on the work on big data carried out by the ITU Telecommunication Standardization Bureau (TSB), see http://www.itu.int/en/ITU-T/techwatch/Pages/big-data-standards.aspx.

[32] http://www.itu.int/en/ITU-T/Workshops-and-Seminars/bigdata/Pages/default.aspx

[33] http://www.itu.int/en/fnc/2014/Pages/default.aspx

adopted a communiqué highlighting challenges including those specific to aviation, and proposed concrete actions for future work and standardization, in collaboration with the International Civil Aviation Authority (ICAO).[34]

Regulation[35]

• What are the key regulatory issues at stake and how can and should big data be regulated?

• How does big data impact the regulation of privacy, copyright and Intellectual property rights (IPR), transparency and digital security issues?

• What is the link between big data and open data?

• Is there a need to regulate data management and service providers?

• How can market dominance in the area of big data be prevented and the rights of the data owners protected?

ICT data collection and analysis

• How can big data complement existing ICT statistics to better monitor information society developments?

• Which type of data from ICT companies are most useful and for which purposes?

• Which new ICT indicators could be produced from big data sources?

• What are key issues that need to be addressed, and by whom, in terms of collecting and disseminating big data in telecommunications?

• What is the role of National Statistical Offices and how can big data complement official ICT data?

UNPulse

Launched by the Executive Office of the United Nations Secretary-General, to respond to the need for more timely information to track and monitor the impacts of global and local socio-economic crises, the UNPulse Initiative explores how new, digital data sources and real-time analytics technologies can help policymakers understand human well-being and emerging vulnerabilities in real-time, in order to better protect populations from shocks[36].

"The initiative was established based on a recognition that digital data offers the opportunity to gain a better understanding of changes in human well-being, and to get real-time feedback on how well policy responses are working. The overarching objective of Global Pulse is to mainstream the use of data mining and real-time data analytics into development organizations and communities of practice. To this end, Global Pulse is working to promote awareness of the opportunities Big Data presents for relief and development, forge public-private data sharing partnerships, generate high-impact analytical tools and approaches through its network of Pulse Labs, and drive broad adoption of useful innovations across the UN System"[37].

[34] http://www.itu.int/en/ITU-T/Workshops-and-Seminars/ccsg/expdial/Pages/default.aspx

[35] A background document on big data that was prepared for the GSR 2014 is available at http://www.itu.int/en/ITU-D/Conferences/GSR/Pages/gsr2014/default.aspx.

[36] Adapted from UNPulse (About) http://www.unglobalpulse.org/about-new

[37] Id.

US: White House, Big Data Initiative

Two major initiative[38] to fund research on six "Big Data" initiatives were announced by the President two year ago to:

- Advance state-of-the-art core technologies needed to collect, store, preserve, manage, analyze, and share huge quantities of data.
- Harness these technologies to accelerate the pace of discovery in science and engineering, strengthen our national security, and transform teaching and learning; and
- Expand the workforce needed to develop and use Big Data technologies.

This year, the Executive Office released two reports: The first report[39] Big Data: *Seizing Opportunities, Preserving Values*, is a comprehensive treatment of the subject. The report urged focus that will move the privacy discussion forward by preserving Privacy Values(both in the United States and through interoperable global privacy frameworks); educating Robustly and Responsibly: Recognizing schools as an important sphere for using big data to enhance learning opportunities, while protecting personal data usage and building digital literacy and skills; Big Data and Discrimination: Preventing new modes of discrimination that some uses of big data may enable; law Enforcement and Security: ensuring big data's responsible use in law enforcement, public safety, and national security; and harnessing data as a public resource, using it to improve the delivery of public services, and investing in research and technology that will further power the big data revolution.

The second report[40], *Big Data and Privacy: A Technology Perspective* examined the nature and evolution of technology and its capabilities and the challenges surrounding protecting individual privacy. What is useful to know from this work is that it concludes with the notion that technology alone cannot protect privacy; policy needs to play a strong role and needs to reflect what is technologically feasible.

This report's policy position centered on five recommendations: to Focus on the use of Big Data, and less on collection; to avoid embedding technological solutions into policy, to focus on research and deployment of technologies that help to protect privacy, to encourage education and career professions and for the US to take the lead both internationally and at home by adopting policies that stimulate the use of practical privacy-protecting technologies that exist today.

It is worth noting that this report became subject to quick debate from privacy advocates indicating that it relies on policy aimed at the use of data, and not as much on its collection. By extension the criticism thought there would be discrimination against the poor, elderly and minorities, and even children – those not in a position to protect themselves – by placing the burden of protection on the individual.

7. The Wrap

The world of Big Data is in its infancy, taking its first steps in what will be a long journey. It will be guided to an extent by decisions made by the Regulatory Authorities in regions and jurisdictions throughout the world. The options are varied, complex, and risky.

We must not lose sight of its great potential, benefitting the individual, organizations and society as a whole. We explained in this paper the underpinnings of why we are at the crossroads of Big Data; what

[38] http://www.whitehouse.gov/sites/default/files/microsites/ostp/big_data_press_release_final_2.pdf

[39] Executive Office of the President; May 1, 2014; http://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf

[40] Executive Office of the President; May 1, 2014; http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_big_data_and_privacy_-_may_2014.pdf

factors have put us in a position to see this opportunity. From those points we see that there is no evidence to believe the trends will reverse anytime soon. We shared only a small handful of benefits already realized by the promising use of Big Data.

We also know that there are a growing number of concerns to protect not only the interests of the individual, but the ability to innovate. This will be the balance struck by those in a position guide or control these opportunities. The public will continually have to believe that there is greater benefit than cost to them to avoid backlash or loss of trust. Such a loss would promise a reversal of the gains seen. What should the Authorities do? We have condensed our policy focus to four points:

- Ensure protection not only for society itself, but for those users of Big Data. Recognize the shift to protect at the point of use and away from the point of collection.
- Protect human free will. Predictive approach to determining societies decisions must be carefully managed to avoid hold those accountable only based on prediction.
- Grow the skills pool of people capable to manage this properly. Talent will be required and needed to insure we understand what we are doing but to give those who believe they are aggrieved by the consequences of Big Data, and are in a position for proper redress.
- Keep data market fluid through a number of oversight tools. Data markets must be kept fluid and robust and proper frameworks are needed to insure that small groups or individuals become the earlier monopoly Trusts that controlled the health and degree of innovation in a segment of the economy.

With the right level of attention today, our children and their children will find a world that has benefited from the creativity and imagination that Big Data offers.

Annex 1 – 15 Worst Data Breaches (2000-2012)[41]

1. Heartland Payment Systems

Date: March 2008

Impact: 134 million credit cards exposed through SQL injection to install spyware on Heartland's data systems. The vulnerability to SQL injection was well understood and security analysts had warned retailers about it for several years. Yet, the continuing vulnerability of many Web-f acing applications made SQL injection the most common form of attack against Web sites at the time.

2. TJX Companies Inc.

Date: December 2006

Impact: 94 million credit cards exposed.

There are conflicting accounts about how this happened. One supposes that a group of hackers took advantage of a weak data encryption system and stole credit card data during a wireless transfer between two Marshall's stores in Miami, Fla. The other has them breaking into the TJX network through in-store kiosks that allowed people to apply f or jobs electronically.

Date: March 2011

Impact: Exposed names and e-mails of millions of customers stored in more than 108 retail stores plus several huge financial firms like CitiGroup Inc. and the non-profit educational organization, College Board. The source of the breach is still undetermined, but tech experts say it could lead to numerous phishing scams and countless identity theft claims. There are different views on how damaging the Epsilon breach was. Since Epsilon has a client list of more than 2,200 global brands and handles more than 40 billion e-mails annually, it could be, "the biggest, if not the most expensive, security breach of all-time."

4. RSA Security

Date: March 2011

Impact: Possibly 40 million employee records stolen.

[41] Taylor Armerding, CSO Online; 15Feb12, 15 Worst data breaches of the 21st Century

The impact of the cyber-attack that stole information on the company's SecurID authentication tokens is still being debated. The company said two separate hacker groups worked in collaboration with a foreign government to launch a series of spear phishing attacks against RSA employees, posing as people the employees trusted, to penetrate the company's network. Among the lessons are that even good security companies like RSA are not immune to being hacked. Finally, "human beings are, indeed, the weakest link in the chain".

5. Stuxnet

Date: Sometime in 2010, but origins date to 2007

Impact: Meant to attack Iran's nuclear power program, but will also serve as a template f or real-world intrusion and service disruption of power grids, water supplies or public transportation systems. The immediate effects of Stuxnet were minimal -- at least in this country -- but it ranks it among the top large-scale breaches because, "it was the first that bridged the virtual and real worlds. When a piece of code can have a tangible effect on a nation, city or person, then we've truly arrived in a strange, new world," he says.

6. Department of Veterans Affairs

Date: May 2006

Impact: An unencrypted national database with names, Social Security numbers, dates of births, and some disability ratings for 26.5 million veterans, active-duty military personnel and spouses was stolen. The breach pointed once again to the human element being the weakest link in the security chain. The database was on a laptop and external hard drive that were both stolen in a burglary from a VA analyst's home. The analyst reported the May 3, 2006 theft to the police immediately, but senior officials at the Veterans Affairs were not told of it until May 16. The VA estimated it would cost $100 million to $500 million to prevent and cover possible losses from the theft.

7. Sony's PlayStation Network

Date: April 20, 2011

Impact: 77 million PlayStation Network accounts hacked; Sony is said to have lost millions while the site was down f or a month. This is viewed as the worst gaming community data breach of all-time. Of more than 77 million accounts affected, 12 million had unencrypted credit card numbers. According to Sony it still has not found the source of the hack. They gained access to full names, passwords, e-mails, home addresses, purchase history, credit card numbers, and PSN/Qriocity logins and passwords.

8. ESTsoft

Date: July-August 2011

Impact: The personal information of 35 million South Koreans was exposed after hackers breached the security of a popular software provider. It is called South Korea's biggest theft of information in history, affecting a majority of the population. South Korean news outlets reported that attackers with Chinese IP addresses uploaded malware to a server used to update ESTsoft's ALZip compression application. Attackers were able to steal the names, user IDs, hashed passwords, birthdates, genders, telephone numbers, and street and email addresses contained in a database connected to the same network.

9. Gawker Media

Date: December 2010

Impact: Compromised e-mail addresses and passwords of about 1.3 million commenters on popular blogs like Lifehacker, Gizmodo, and Jezebel, plus the theft of the source code for Gawker's custom-built content management system. Online forums and blogs are among the most popular targets of hackers.

10. Google/other Silicon Valley companies

Date: Mid-2009

Impact: Stolen intellectual property

In an act of industrial espionage, the Chinese government launched a massive and unprecedented attack on Google, Yahoo, and dozens of other Silicon Valley companies. The Chinese hackers exploited a weakness in an old version of Internet Explorer to gain access to Google's internal network. It was first announced that China was trying to gather information on Chinese human rights activists.

11. VeriSign

Date: Throughout 2010

Impact: Undisclosed information stolen

Security experts are unanimous in saying that the most troubling thing about the VeriSign breach, or breaches, in which hackers gained access to privileged systems and information, is the way the company handled it -- poorly. VeriSign never announced the attacks. The incidents did not become public until 2011, through a new SEC-mandated filing. VeriSign said no critical systems such as the DNS servers or the certificate servers were compromised, but did say that, "access was gained to information on a small portion of our computers and servers."

12. CardSystems Solutions

Date: June 2005

Impact: 40 million credit card accounts exposed.

CSS, one of the top payment processors for Visa, MasterCard, and American Express is ultimately forced into acquisition. Hackers broke into CardSystems' database using an SQL Trojan attack, which inserted code into the database via the browser page every four days, placing data into a zip file and sending it back through an FTP. Since the company never encrypted users' personal information, hackers gained access to names, accounts numbers, and verification codes to more than 40 million card holders.

13. AOL

Date: August 6, 2006

Impact: Data on more than 20 million web inquiries, from more than 650,000 users, including shopping and banking data were posted publicly on a web site. In January 2007, Business 2.0 Magazine ranked the release of the search data in among the "101 Dumbest Moments in Business." AOL Research released a compressed text file on one of its websites containing 20 million search keywords for more than 650,000 users over a three-month period. While it was intended for research purposes, it was mistakenly posted publicly. AOL pulled the file from public access by the next day, but not before it had been mirrored and distributed on the Internet.

14. Monster.com

Date: August 2007

Impact: Confidential information of 1.3 million job seekers stolen and used in a phishing scam. Hackers broke into the U.S. online recruitment site's password-protected resume library using credentials that Monster Worldwide Inc. said were stolen from its clients.

15. Fidelity National Information Services

Date: July 2007

Impact: An employee of FIS subsidiary Certegy Check Services stole 3.2 million customer records including credit card, banking and personal information. Network World reported that the theft was discovered in May 2007. But the theft was not disclosed until July. An employee allegedly sold the data for an undisclosed amount to a data broker.

International Telecommunication Union

GSR Discussion paper

New frontiers in Spectrum Licensing

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 20 June 2014.

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Table of contents

1 NEW FRONTIERS IN SPECTRUM LICENSING

Author: John Alden and Catherine Schroeder (Freedom Technologies, Inc.)

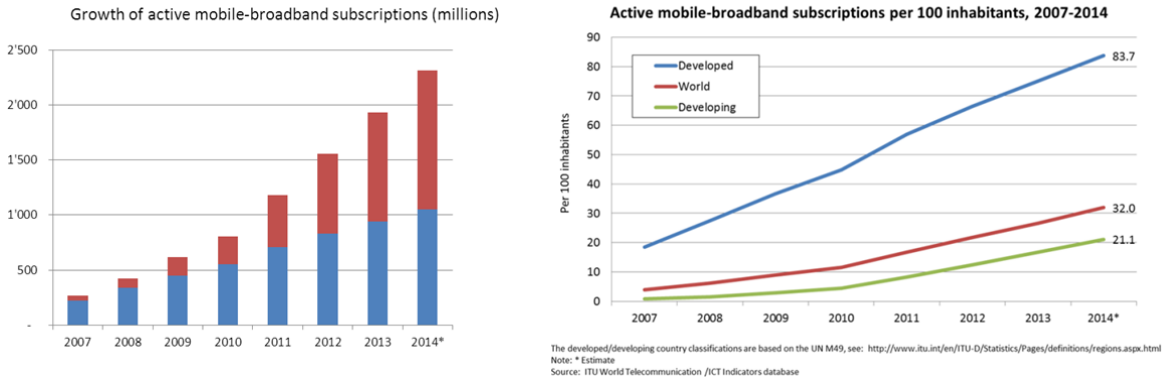
1 Introduction: Regulators under Pressure

Spectrum managers in countries around the globe today face strong pressure to free up access to more spectrum for broadband wireless network access. Prompted by a sharp and accelerating rise in wireless broadband subscriptions in many countries (See Figure 1), regulators are scrambling to find more spectrum for the wider channels and greater throughput available with advanced wireless technologies such as Long-Term Evolution (LTE).

In responding to the need to utilize spectrum for the public good, regulators look to – and act through – the ITU, where the process of satisfying spectrum requirements for wireless broadband plays out, culminating in frequency allocation decisions at World Radiocommunication Conferences (WRCs). National authorities (governments and/or regulators) then allocate spectrum nationally and license it to network operators. In addition, regulators can deploy flexible licensing options to meet the need for more spectrum, taking advantage of emerging technical solutions for sharing spectrum.

In the context of ITU's framework for spectrum allocation – which is building toward a WRC in November 2015 – regulators and telecommunication manufacturers and operators are exploring ways to accommodate new broadband spectrum access while not harming incumbent services. Along with this, in an effort to find solutions to share existing spectrum, some policy-makers at the national level are now exploring new approaches to spectrum licensing. As a result, some old certainties and assignment methods that were based on clear lines between licensed and licence-exempt frameworks are beginning to blur – with potentially uncertain results. Database and sensing technologies are driving opportunistic sharing, challenging current licensing conventions.

Figure 1: Growth in mobile broadband, 2007-2014



Note: * Estimates
Source: ITU World Telecommunication /ICT Indicators database

This paper looks at this exploration, now under way in some countries, about how to accommodate broadband spectrum expansion while not obliterating incumbent spectrum uses. This is an examination of new approaches such as *licensed shared access* (LSA) or *dynamic frequency selection* (DFS), which in some ways build upon the more-established success of unlicensed, short-range and low-power devices (i.e., Wi-Fi) and the less-established "white spaces" systems.[1] These sharing-based approaches may be useful complements to existing options, such as spectrum auctions, tender processes and spectrum re-farming, which have been used to award spectrum in cases where there are multiple applicants for the same spectrum.

This regulatory discussion is also about the use of "small cell" and "local area" network topologies to augment traditional mobile cellular networks. And in the near future, this debate will focus on using cognitive radio systems to "sense and avoid" other transmitters in a dynamic, real-time way.

The various experiments in sharing and spectrum management explored in this paper prompt several real questions. How practical are these sharing innovations in many countries, and how should regulators protect rights of use and access – the traditional rationale for spectrum licensing – for all users who need that access? These questions are just now being explored. But there is a broader question: Are such fluid sharing and licensing strategies really needed – and if so, where and in what circumstances?

2. The Evolution of Spectrum Licensing

It is common to perceive of spectrum as real estate, with spectrum management taking on the role of land management. In this analogy, allocation becomes a form of zoning, and a licence becomes a kind of spectrum deed or lease agreement. The holder has certain rights of usage, which are determined and articulated in regulations, licence terms or concessions. The government retains some of the spectrum for its own uses, and it even may set aside some spectrum "land" for the public good – a sort of spectrum "park" for everyone's common use. Spectrum with good propagation characteristics is often called "beach-front property" because of its high utility for mobile services, broadcasting and other important uses. The analogy of spectrum to land is so useful that in many ways, it has come to influence the very way we envision spectrum and how it is used.

Some spectrum engineers and policy-makers, however, have come to view the acreage analogy as overly limiting. In their view, thinking of spectrum as a static resource or commodity is not helpful in a policy environment that increasingly emphasizes ways to squeeze more usage out of the same laws of physics. After all, radio-frequency spectrum *isn't* land. It is a means of transporting radio frequency energy, in the form of signals, from transmitters to receivers. One cannot mine spectrum. It cannot be trapped, saved, contained, transported or stored. Spectrum will never be "used up" or exhausted. It is not even Earth-bound (we are now receiving signals from a 36-year-old space probe, Voyager 1, at the very edge of our solar system).[2] On the other hand, there is no doubt that spectrum is a natural resource that is limited in terms of amount of usable frequencies and the number of users having access to specific frequencies.

Perhaps it's helpful to think of spectrum in terms of resilience and agility. In other words, the best way to approach spectrum is by exploring and pioneering better ways to transmit and receive signals among more users without disrupting one another's messages. Rather than being about ownership (tacit or otherwise), spectrum management is properly a task of increasing *access* while

avoiding *harmful interference*. The hope is, increasingly, that science, regulations and technology will help deliver on that task.

2.1 Current Spectrum Assignment Models

Before exploring the new experimentation in spectrum licensing, however, it might be useful to review how spectrum is currently assigned and how those methods evolved. This is important, because in many ways, new ideas about spectrum licensing represent an evolution from existing frameworks.

A 2012 ITU paper on spectrum value and valuation defined several broad perspectives on spectrum assignment and usage:[3]

- The *administrative licensing* model -- Most often employed for (but not limited to) government spectrum usage, this command-and-control approach entails determining the spectrum requirements of public-service or administrative agencies -- including law enforcement/public safety, military, science or infrastructural requirements – and simply making assignments in the appropriately allocated bands. This model is also used whenever the demand for spectrum can be handled on a first-come-first-served basis, as for radio relays, professional radio or satellite earth stations. In this case, annual fees may be charged to the users to cover the spectrum management costs and/or reflect the value of spectrum.

- The *flexible rights-of-use* model -- This model adopts an inherently economic perspective on spectrum licensing, letting the market determine the value of spectrum through auctions and secondary markets, offering to licensees the flexibility to use the spectrum in the most economically rational way.

- The *licence-exempt* model – Taking advantage of low-power, short-range transmitters, the licence-exempt model treats spectrum as a public "commons" that can be used and shared without licensing it. However, this model does not imply that unlicensed devices can operate in an unrestricted way – they are not "unregulated." They must comply with a set of detailed technical and operational specifications, often listed in so called "general licences" or "class licences," in order to enable compatible use of a frequency band by the same or different radiocommunication services.

While these models represent distinct philosophies about what spectrum is and how it can be used, they are not mutually exclusive. In fact, most countries' spectrum management regimes are pragmatic combinations of all three approaches. The administrative licensing model is the baseline practice, having been in place before the other two approaches were defined. It is still employed for many types of uses, whenever the demand for spectrum can be handled on a first-come-first-served basis. In such cases, governments generally levy fees on private-sector licensees (a process known as "administrative pricing') for the use of spectrum and/or to cover the spectrum management costs.

For commercial wireless services, however, many governments have made spectrum available through licensing, giving licensees rights of use (most often exclusively) for a set period of time and subject to delineated conditions. Cellular mobile network operators are, of course, the most common examples. The flexible right of use model, however, commonly comes into play in licensing

whenever there are more potential users than there are channels or licences to be distributed. Some form of auction or tender process can then be used to determine the economically best-situated applicants for those limited licences.

Table 1 -- Applications of the Three Spectrum Distribution Models

Model	Typical Users	Typical Uses

Administrative Licensing	• Government agencies
	  ▪ Military
	  ▪ Public safety
	  ▪ Resource managers
	  ▪ Transport operators
	• Broadcasters
	• Professional users
	• Earth station operators
	• Fixed Telecom infrastructure operators
		• Radars
		• Aeronautical and maritime
		• Tactical radios
		• Remote sensing
		• Terrestrial Television broadcast-ing
		• Professional mobile radio
		• Point-to-point links
		• Satellite telecommunications

Flexible Rights of Use	• Commercial terrestrial wireless operators • Satellite operators	• 2G, 3G and 4G mobile services • Satellite broadcasting and telecommunications • WiMax or fixed wireless
Licence-exempt	• Internet hotspot providers • Individuals	• WiFi (WLANs) • Other Low-power devices (key fobs, garage openers)

Finally, governments have increasingly established modes of licence-exempt or class-licensed usage for a wide range of consumer devices, ranging from automobile key fobs up to Wi-Fi "hot spots" – and everything in between. Wireless routers, baby monitors and hotel wireless networks all function on the unlicensed/commons model, usually in discrete bands set aside for unlicensed usage (these may include bands in the 900 MHz, 2.4 GHz and 5 GHz ranges).

At a global level, there has been some exploration of how incumbent services can be protected while sharing spectrum with some of these limited-range consumer devices. At the World Radio-communication Conference in 2003 (WRC-03), for example, the ITU opened up the possibility to use parts of the 5 GHz range for wireless local area networks (LANs), with portions of the spectrum being shared with radars in the incumbent, primary radiolocation service. This was the first example of a cognitive radio, established through a technology known as *Dynamic Frequency Selection* (DFS) (See Section 3.2.4). It also foreshadowed the concept of allowing, under controlled circumstances, *dynamic spectrum access* (DSA) to radio-frequencies by unlicensed devices. This early experiment in

DSA, however, yielded mixed results. Interference problems were reported as a result of unlicensed equipment operating with disabled DFS capability.

2.2 The "Pros" and "Cons" of Current Assignment Models

Perhaps it is time now to take stock of the conventional wisdom about these three assignment approaches. Have these models, mixed and matched and applied in various combinations, led to optimal uses of spectrum? How could they be tweaked or even overhauled to achieve better results?

2.2.1 First the "Pros"

As a threshold analysis, it is worth noting that the very **pragmatism** of most current assignment regimes may well be their greatest strength. Put simply, it seems to make sense to apply different assignment strategies to different types of uses. For example, the operating characteristics of most equipment used on an unlicensed basis obviate the need to require a licence. These characteristics include low power, short range, and use in bands where they can only interfere with each other and are allowed to operate only on a non-protected basis. It makes little sense from a practical standpoint to license every consumer product that uses radio frequencies to function under these conditions. Governments certainly have an interest in type-approvals and equipment certifications to ensure that these operating characteristics are met. But this can be essentially opaque to the consumer, who just needs to find the correct size of batteries to become a "wireless operator" – at least of their own mobile phones or netbooks.

By the same token, requiring large, often multinational corporations to pay a market-based price for one of their most necessary operating inputs (i.e., spectrum) also makes sense. From the government's perspective, operators are less likely to waste or "warehouse" spectrum if it does not come cheaply or in overwhelmingly large supply. Moreover, it would be irrational from a business perspective for an operator to pay more for such an input than it could earn through providing the eventual output (the telecommunications service). So, attaching the proper economic value to spectrum allows operators to make rational decisions about how to use the resource most efficiently and effectively. (This issue is discussed in detail in ITU-R Report SM.2012 "Economic aspects of spectrum management," which analyses financial and economic mechanisms that contribute to effective management of frequencies and spectrum efficiency.)

Meanwhile, if governments expect operators of capital-intensive networks to make sufficiently large, long-term investments in spectrum and network construction, it makes sense to grant spectrum access rights on an exclusive basis – i.e., within a certain spectrum band and in a particular geographic area. Thus, the property rights model is conducive to providing large operators the kind of stability and predictability that they need to invest in market entry.

Another advantage of current licensing approaches is that they generally provide regulators with sufficient tools to make and enforce decisions on **market structure and interference management**. The administrative licensing model, naturally, represents the most rigid framework (in the past it was sometimes characterized as "command-and-control" licensing) for allowing some uses and disallowing others. Most governments feel they need to maintain direct control over a certain amount of spectrum in order to facilitate some uses that would be impossible or un-economical for the market to provide, but that are necessary or important for the public good. With regard to commercial

licences, regulators can use their licensing power to release an optimal amount of spectrum into the marketplace, and they can influence operators' behavior through the ability to amend or revoke those licences or the regulations that govern them.

One of the advantages of the individual licensing model is that it provides regulators with information on the usage of specific frequency bands. This allows the establishment of national databases containing information on the frequency assignments that have been made to operating stations. Such databases assist in interference management and in preventing unauthorized or abusive use of frequencies. They may also represent a critical element for dynamic spectrum access technologies, as this paper will explore in Section 3.

In addition, many licensing regimes now have built-in **flexibility**, because they provide for technology neutrality, service neutrality and unified licensing. Earlier, command-and-control licences prescribed exactly what service could be offered, using exactly which technology. As part of "lighter touch" regulatory reforms, however, regulators often refrain from such prescriptions. They may even issue licences that allow recipients an open-ended choice to provide service using a combination of wireless and wireline technologies (i.e., unified licensing). These innovations enhance the general pragmatism of many updated spectrum management regimes.

So an important conclusion is that licensing regimes based on the existing approaches to spectrum assignment continue to function in many ways and in many countries. For regulators, these licensing regimes provide a useful toolkit for planning, allocation and assignment of frequencies in ways that respond to their market realities.

2.2.2 Then the "Cons"

Perhaps the biggest drawback of current spectrum licensing regimes may be that, in the face of perpetually accelerating usage demand in many economies, they may not be pragmatic or flexible *enough*. This critique points to spectrum in the critical bands below 6 GHz and sees gridlock. Through administrative assignments to government agencies, many bands are often used by governmental and public applications, which may not always be spectrum-efficient.

The legacy of commercial licensing, meanwhile, is a lengthy list of bands that also are tied up in existing fixed and mobile service licences, leaving little room to introduce newer generations or competitive new market entrants. The bands reserved for unlicensed usage, meanwhile, may not be sufficient to accommodate the number and variety of uses, even as newer generations of RLANs are poised to feature larger channelization requirements and expanded capacity.

Spectrum managers might be able to handle the growing spectrum constraints in their own, measured fashion if it were not for the crisis calls of the wireless industry for additional access to mobile service spectrum for IMT networks and RLANs.[4] This is clearly being driven by the perceived market for broadband transmission of multimedia content. No operator wants to lack sufficient spectrum or have its network perceived as being incapable of providing sufficient bandwidth. And this market imperative is nearly always joined by government policy mandates to build out ubiquitous and affordable broadband networks. Indeed, wireless access is often a key element of both operators' and policy-makers' broadband strategies.

As a result, some policy-makers and companies are looking beyond the traditional spectrum planning, allocation and licensing regimes in search of answers about how to re-purpose spectrum more rapidly. The shortcomings of each traditional model, according to this critique, can be summarized as follows:

- *Administrative Licensing* – Whether they are government departments and/or broadcasters, current licence-holders often control large amounts of spectrum over long periods of time – and often in bands with the best propagation characteristics. Critics often contend that this spectrum is under-utilized, used inefficiently and held under opaque and outdated terms and conditions. [5]

- *Flexible rights-of-use* -- Once licences are obtained, commercial licensees are commonly given exclusive spectrum rights for fairly long periods, with varying degrees of accountability for how they use that spectrum.

- *Licence-exempt* – By definition, unlicensed spectrum bands offer few statistics on numbers of users or service providers. There are increasing signs that manufacturers are eager to offer greater capacity and capability, potentially boosting the demand for spectrum for RLANs and consumer devices – with an unpredictable set of results.[6] Lurking in the background is the potential for overuse of licence-exempt bands and constrained access to sufficient spectrum.

3 The New Frontier: Gaining More Usage from "Less" Spectrum

Whether it's wine, olive oil or apple cider, every commodity has what can be called "second pressings." Once the initial pressing (or stomping or threshing) has been completed, one doesn't simply accept that the resource is drained and then walk away. Rather, the process is repeated, often multiple times, to ensure that every last ounce or gram is gleaned from the precious resource. Often, it is the ninth or tenth pressing – even with a weaker or more diluted product than the initial, "virgin" pressing – that yields enough profit to last until next year.

Spectrum managers are looking for methodologies to generate just such "second pressings" of radio-frequency spectrum. They need to find ways to generate more usage of this scarce resource, and they are under severe pressure to do so rapidly.

At the same time, however, they know that the quality and usability of such spectrum "second pressings" do not unduly degrade the quality of the "first pressings." In essence, this is the conundrum of spectrum sharing: how to allow more access for some users without causing interference to all of the others. Many regulators are justifiably cautious, therefore, in examining the options for sharing and how those approaches will affect existing rules and incumbent stakeholders.

3.1 Options for "Second Pressings"

If one looks at an allocation table (either the ITU's global allocation table, incorporated in the Radio Regulations, or a national table), there appears to be no such thing as unused spectrum. There is an allocation label on every band (and frequently more than one per band). Indeed, if spectrum were land, every inch already would be occupied. With spectrum, however, we are not speaking of concrete and steel but of signals, which can vary in terms of strength, wave form and time (i.e., pulses or changes defined by duty cycles). What spectrum monitoring equipment may

detect is not necessarily a static edifice of signals, but rather a complex ballet of energy, which can vary and be influenced by power limitations, directional antennas or "bursts" of data. To simplify, even when a certain frequency is allocated and assigned, it is not always in use, or "occupied" by a transmission, 100 per cent of the time, or over 100 per cent of the territory.

Again, employing a perhaps over-simplified model, spectrum usage can be envisioned in three dimensions:

(1) Frequency
(2) Time
(3) Physical space/geography

In other words, spectrum use can be perceived as cubic or "three-dimensional," and the empty lapses or "white spaces" left open in these three dimensions are opportunities for **sharing** among different uses, whether they are completely different radiocommunication services or just different transmissions within the same service. These opportunities for sharing are briefly explored in the following sub-sections.

It is important to note, however, that the "cube" concept only goes so far in explaining the concepts behind sharing. It does not take into account the ways energy is radiated, including power levels, how receivers can vary in sensitivity, differences in wave forms, etc. These elements of physics and radio engineering are pivotal in understanding how to boost equipment performance and prevent interference. A comprehensive overview of sharing methods can be found in Report ITU-R SM.1132 "General principles and methods for sharing between radiocommunication services or between radio stations."

3.1.2 Frequency-based sharing

Within any licensed block of spectrum, there are multiple frequencies that are commonly grouped together as *channels*, and spectrum-dependent systems commonly are designed to be tuned across multiple channels. Regulators can consolidate or "re-pack" existing channels, and such re-channelization can result in greater access to channels by new operators. Depending on factors such as the power levels employed by transmitters, the ability to boost signals by directional antennas, and other technical variables, even different services could share a previously monolithic spectrum block – perhaps with retention of a "guard band" to act as insulation between the two different services. Some types of services need to have separate channels for downlinks and uplinks (satellites and cellular mobile services, for example), and these channels can be alternated or "interleaved" with channels assigned to other services or operators.

Technological advances constitute a double-edged sword for frequency sharing in this manner. On the positive side, more efficient equipment, including advanced antenna systems, can achieve equal throughput using smaller channels, allowing a process known as "narrow-banding."[7] This constitutes essentially re-farming current operators on the same spectrum, but on narrower channels (e.g., downshifting from a 25 kHz channel to a 12.5 kHz channel). On the other hand, the growth of broadband mobile services is actually prompting expansion of channels to achieve greater capacity for data, with transmission standards calling for channels of 20 MHz or even wider.

3.1.3 Time-based sharing

Similarly, wireless transmissions occur continually – but very seldom are they continuous. The range of periods when transmissions are not taking place can range from fractions of seconds, in the case of "bursty" data or radar pulses, to long strings of hours, such as when broadcasting stations suspend programming overnight. Through pro-active coordination or regulation, technical protocols or operational agreements can allow sharing to take place through utilizing these gaps in timed transmissions or duty cycles.

3.1.4 Geographic-based sharing

Perhaps the most common – and easily achievable – form of sharing is re-use based on geographic separation. Maritime radio systems may be able to use the same frequencies as land-based transport fleets – provided that they are de-conflicted in the port areas where they may overlap. Geographic separation can be achieved purely through such differences in usage or by creating geographic exclusion zones that preclude operation of one type of wireless system in the area reserved for another.

Geographic sharing can also be facilitated by limiting the power level, range and directionality of one or more types of systems, thus precluding, or at least minimizing, the potential for interference with other operators in the same bands (or in adjacent bands). Indeed, all three dimensions of sharing are made possible through a combination of regulatory requirements (often, but not always, imposed through licensing) and technological requirements. The latter are built into equipment through standards development, certification and national-level type approvals. The technological changes in recent years that have paved the way for greater sharing are explored in more detail in Section 3.3.

Several governments already have experimented with the sharing among diverse users, at least in limited ways. The most common response has been to allow unlicensed or *class licence* operation of low-power, short-range consumer and WiFi equipment. Such short-range devices, such as those empowered with Bluetooth or WiFI capabilities, are a prime example of interference-avoidance that uses a combination of geographic separation and power levels. However, if large numbers of such devices proliferate in a given area, such as a densely populated urban zone, they can raise the overall spectrum *noise floor* to a level where the devices begin to cause interference (or capacity loss) to each other and to other services in the same or adjacent bands – the classic drawback to a spectrum "commons" approach.

So far, we have examined the evolution of basic sharing techniques that have become fairly common in their application across many countries. The following sections explore some techniques that have evolved in some countries, but are less commonly applied in many of them. Where there are drawbacks, or where results have been sub-optimal, these results will be noted.

3.1.5 Subdividing Licences – Spectrum Disaggregation and Trading

Within the realm of individually granted licences, there are also ways to achieve spectrum re-use. The simplest way is simply to establish smaller licensing areas rather than issuing a nationwide licence for each band. Some countries establish different-sized licensing areas for licenses intended for auction, allowing smaller market entrants an opportunity to gain spectrum niches in selected urban markets or in rural areas not coveted by larger carriers. For some administrations, however,

the downside to this approach may be creation of non-lucrative licence areas that go unwanted as operators "cherry-pick" more densely populated or wealthy market areas.

Another way to generate re-use is to subdivide a licence geographically, allowing different operators to use the same spectrum in different locations. This is known as licence disaggregation, and it has been allowed in some countries, within some bands, for more than a decade.[8] This can be achieved by creating entirely new licences, or through spectrum leasing arrangements (which can also subdivide spectrum bands through leasing a portion or channel of a given band).

The "TUF" *(Titulo de Usufructo de Frecuencia)* pioneered in Guatemala provides an example of a tradable "property right" that allows a holder to exercise flexibility in a given band of spectrum as long as they adhere to technical criteria governing:

- Maximum transmission power;
- Coverage area;
- Maximum interference at border of coverage area; and
- Schedule of operation.[9]

Some experiments include the idea of "band managers" – entities that oversee (and take responsibility for) use of spectrum by a collection of subsidiary users. As explained in the ICT Regulation Toolkit, "A band manager will typically have assignment rights over, or be the licensee of, a block of spectrum, which it will then subdivide among many users. In many respects, a band manager can be thought of as a 'wholesaler' of spectrum, which it then 'retails' to individual users." [10]

As these descriptions indicate, spectrum "trading" can be defined to include some very different processes. One form of such trading is the transfer of a licence from one entity to another through approval of an acquisition or merger of the license-holder. In many countries, regulators must approve such transfers, which essentially give regulators a chance to determine whether, in fact, consolidation of two previously competitive market players would be in the public's interest. The other processes of trading, such as tradeable rights or disaggregation and leasing, as mentioned above, have been much more rare – and implementation has not always brought about the desired results.

Initial experimentation in spectrum trading was confined to a handful of countries: notably, Australia, New Zealand, United States, Canada, and Guatemala. [11] In this decade, the Office of Communications (Ofcom) in the United Kingdom has been active in authorizing spectrum transfers and leasing.[12] As a whole, the European Union has taken a cautious approach to spectrum trading, viewing both its potential benefits and possible draw-backs in terms of market failures from spectrum hoarding and lessening of competition.[13] Where trading rules have been approved, initial trading levels have often been disappointing, leading to questions about the utility of the concept.

The OECD has noted concerns among some countries about potential unforeseen effects of introducing spectrum trading (at least in terms of allowing leasing or transfer of discrete spectrum bands), summarizing those concerns as:

- Low spectrum trading activity
- Inefficient use of spectrum
- High transactions costs

- Risk of increased interference
- Impact of spectrum trading on anti-competitive conduct
- Impact on investment and innovation
- Impact on international co-ordination / harmonisation
- Windfall gains
- Disruptive effect on consumers
- Reduced ability to achieve public interest objectives.[14]

For most regulators, the idea of fungible licensing areas and transferring responsibility to other entities is worrisome, or even alarming. In addition to potential cherry-picking of small geographic markets, most concerning to regulators is the idea of losing direct control over licence-holders that may be able to transfer, lease out or (in practical terms) sell their licences. This loss of control may result in speculation (buying up fallow spectrum and selling it later at a profit) or commoditization of access. Leaving aside those concerns, regulators may have a simple fear of losing sight of who ultimately controls (and is responsible for) a licence. In terms of enforcement, such a loss of control could endanger the regulator's ability to safeguard and regulate the use of spectrum resources, bridge the digital divide or resolve interference cases.

Spectrum subdivision and trading, however, can be made subject to regulatory approval. And the ability to flexibly add and subtract access to spectrum in different geographic markets is, at least in theory, economically empowering. Operators can generate capital for network expansion by leasing out unused spectrum in certain areas, or they can buy up and aggregate licences in new markets as they grow. In short, spectrum disaggregation and trading implies acceptance of a kinetic spectrum environment rather than a static one. Business plans can evolve, change and grow as operators expand or retrench, using as much spectrum or as little as they need at any given stage of market penetration.

For now, however, spectrum trading remains limited in terms of global acceptance by regulators. This is based partly on core regulatory concerns about unintended outcomes, as noted above, and partly on a limited and mixed track record for outcomes of spectrum trading – even where it has been enthusiastically embraced.[15]

3.1.6 Spectrum Re-Farming

Re-farming of spectrum is the process of re-purposing a block of frequencies from an existing use, which may no longer be optimal, to another, more productive use. (Detailed analysis of methods and challenges of spectrum re-farming can be found in the Report ITU-R SM. 1603 "Spectrum redeployment as a method of national spectrum management.") Sometimes the term re-farming is applied as a synonym for relocation of an incumbent user out of a band to make way for re-assignment of that spectrum (See Box 1). For example, a non-commercial government or industrial band could be cleared of existing users and then licensed for a commercial service. That band could be said to have been re-farmed for a new use.

Re-farming does not necessarily involve clearing a band or switching spectrum rights from one user to another. Existing licence-holders may decide, or be directed to, re-farm a band from an older, less-productive technology to a newer one. This would occur, for example, when a cellular mobile operator phased out or discontinued 2G service, enabling it to use the same spectrum band to launch 3G or 4G service. In 2013, for example, T-Mobile informed its U.S. customers, via a blog

post on its website, that it would be reducing the amount of spectrum dedicated to its 2G service and re-farming much of that spectrum for its newer, more advanced network services.

> "Approximately 90% of our network traffic is on our 3G and 4G bands (1700 MHz and 2100 MHz), which is leaving our 2G bands (850 MHz and 1900 MHz) underused," T-Mobile explained. "To help make best use of our 2G bands, we will be re-farming the excess 1900 MHz spectrum from EDGE technology to HSPA+. This will not eliminate 2G 1900 coverage in an area, but will free up some of that spectrum for 4G services. This reallocation will result in increased 4G capacity, smoother connections, and fewer dropped calls."[16]

Box 1: Re-Farming Cellular Spectrum in India[17]

In India, the term "re-farming" is being applied to the original GSM licences in the 900 MHz band, which are due to reach their termination points, beginning in November 2014 (for some of the licence areas or "circles," as they are known). The government's Department of Telecommunications has proposed reclaiming all or a portion (i.e., all but 2.5 MHz) of the licences in the 900 MHz spectrum, then putting the spectrum up for auction. In addition, the government also would auction spectrum in the 1800 MHz band.

The existing licensees in 900 MHz (notably, Bharti Airtel and Vodafone) are, not surprisingly, not in favor of relinquishing the spectrum or seeing it refarmed for a new auction. The existing operators, represented by the Cellular Operators Association of India, argue that reclaiming the 900 MHz spectrum would lead to higher consumer costs, particularly if operators are forced to relocate voice services to networks in the 1800 MHz band. The latter band would entail greater costs because of the relatively worse propagation characteristics compared with the lower band.

One recent example of spectrum re-farming is the re-purposing of a portion of the UHF bands in many countries to allow broadband mobile services to operate there – a process known as the "digital dividend." The transition from analog to digital television broadcasting allowed portions of the 700 MHz and 800 MHz bands to be freed up for new usage. Following spectrum allocation and identification decisions made at WRC-07 and WRC-12, a large and growing number of countries have opted for re-deployment of this frequency resource from broadcasting to mobile broadband, in order to optimize spectrum benefits for their economies and societies.

Even with the licensing techniques reviewed in this section, which have been employed over the past several years with increasing frequency, the ongoing pressure to accelerate and facilitate sharing is prompting further experimentation on sharing. As the next section discusses, there are several technological applications that provide the basis for potential sharing innovations.

3.2 Technology enablers of greater sharing and re-use

As mentioned in the previous sections, technology development is helping to make sharing more feasible in circumstances that would have been more problematic, if not impossible, in previous decades. In fact, technological innovations feature prominently in the new licensing options that are being explored. These options are somewhat blurring the lines between licensed and unlicensed

approaches as they seek to enable sharing in a more dynamic manner. Among the technology developments are:

- **"Small cell" systems (micro-cells, pico-cells, femto-cells)** – Taking the short-range, low-power concept and running with it, these systems operate very small cells and advanced modulation techniques that can provide large bandwidth and excellent spectrum re-use capabilities, essentially recreating a broadband network in a confined location, but linking it to the Internet via wired or point-to-point wireless backhaul links.

- **"Smart" antenna systems** – Developments in antenna technology, including phased-array, reconfigurable directional antennas, are allowing antennas to be incorporated, along with power limits and other techniques, as tools for mitigating interference.

- **Databases** – Envisioned to be used as part of TV white-spaces operations, they rely on the location and technical profile of protected users in a spectrum band to allow dynamic avoidance of interference between these users and lower priority, unlicensed users.

- **Dynamic Frequency Selection (DFS)** – Developed for coexistence among unlicensed Radio Local Area Network (RLAN) devices and incumbents in the 5 GHz range, DFS incorporates monitoring technology that triggers RLAN transmissions to move to another frequency when sensors detect signals from protected incumbents.

- **Cognitive Radio Systems (CRS)** – Like DFS, CRS systems sense the presence of other users in the band and avoid interference with them, "intelligently" hopping to unused frequencies in the presence of other signals. Fully realized CRS systems, however, are largely in the future.

Put together, these technologies are enabling "smarter" wireless operations, sharpening the ability to transmit without causing interference and, ultimately, improving the chances for sharing with other users in the same or adjacent band.

3.2.1 Small-cell systems

A standard or "macro" wireless cell can cover a range of tens of square kilometers and thousands of handsets. Smaller cells, known as microcells, picocells and femtocells, cover much smaller areas (as small as a 10-metre radius in the case of femtocells) and allow low-power usage.[18] This also allows for spectrum re-use and minimizes potential interference. Small cells permit better cell-edge performance and provide increased capacity in high-traffic public areas. They can be used either with or without licences; they can be used to extend the networks of licensed operators within buildings or in more remote areas (at less cost).

One use of small cells, however, is for offloading data traffic from the larger macro-cells. So common is small-cell offloading in some markets that experts predict that as much as half of all data traffic in some congested areas will be offloaded in the next few years, making small cells an integral part of some 3G network topologies. [19] This is one aspect of a trend towards using different types of network technology to deploy what is known as a heterogeneous network or "het-net," which can allow for flexible deployment of cost-effective network equipment and boost the ability of an operator to handle increased capacity demands.

3.2.2 "Smart" Antenna Systems

Smart antenna systems can include switched-beam or adaptive-array antennas, and they feature advanced signal-processing capabilities to engage in *beam-forming* and *direction-of-arrival* estimation. Essentially, they improve performance and efficiency of a radio system, which pays dividends in terms of sharing or co-existence with other radios in the same or adjacent bands. One prime example of a smart antenna technology is *multiple input/multiple output* (MIMO), which offers increased throughput without having to increase power levels or bandwidth. Because of this capability, MIMO is an important component of LTE and other current mobile service technologies.

3.2.3 Databases

One way to control interference is to avoid transmitting on channels being used by other systems in the vicinity. Databases can be used to store and make available information on the channels that may be used by lower-priority radio systems at a given location without causing interference to, or suffering interference from, the higher-priority systems authorized in the band. Any unlicensed device seeking to transmit in that band could perform a "look-up" in the database to obtain information on the available channels. As long as the device transmits only on those channels – and as long as the database is sufficiently updated – the device may be able to operate without causing or receiving interference.

This use of a database is at the heart of current *TV white space* rules and experiments in sharing (see Section 3.3.3). White-space operations can be considered an experimental form of DSA, or as it sometimes is called, "opportunistic sharing" – the practice of using, on a non-interference and non-protection basis, the gaps in transmissions by licensed incumbents. In this case, broadcast stations are generally at fixed locations, with prescribed and well-known technical parameters for transmission. In the case of wireless microphones, these can be localized based on registration of major events (i.e., concerts or festivals) and inputted into the databases, as well. This provides a generally static and relatively stable spectral environment that can be documented in the database. In some limited-time events, however, programme-making and special events (PMSE) management may be required.

3.2.4 Dynamic Frequency Selection (DFS)

Adopted for use by unlicensed devices in several sub-bands of the 5 GHz range (the 5150-5350 MHz and 5470-5725 MHz bands), dynamic frequency selection (DFS) is designed to protect incumbents in those bands from interference. The unlicensed Wi-Fi devices operating in this band are required to be equipped with DFS capability, which can monitor and detect its local spectrum operating environment. If it detects any signals from the licensed systems it is required to protect, the unlicensed device will cease transmitting on that frequency. It can then switch to another frequency (if that one is not being used) and continue operating without causing interference.

DFS featured prominently in discussions of authorizing wireless radio local area networks (RLANs), in the 5 GHz bands during WRC-03. Supporters of allowing Wi-Fi operations in those bands advocated DFS as a regulatory protection for incumbents, which included operators of radars and other equipment with sensitive reception characteristics.

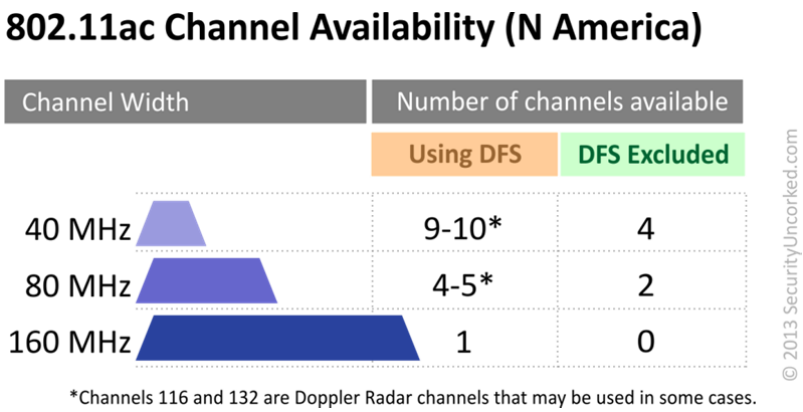
DFS was controversial then, and it has not turned out to be a panacea in the decade since WRC-03. In some cases, RLAN devices that were supposed to be equipped with DFS capabilities have

failed to turn off, causing interference to radars.[20] In other cases, devices designed to operate in multiple unlicensed frequencies were deployed in the bands where DFS is required, but those devices did not have functioning DFS capabilities – which also led to interference. Because the RLAN devices are not subject to licences, it is not practical to locate or account for all of them, so enforcement becomes difficult if operators use equipment not designed for this band (i.e., without functioning DFS capabilities, or if these capabilities deliberately are disabled by the operator).

Moreover, the necessity of employing DFS-equipped gear in the relevant bands appears to have prompted some avoidance of these bands by some industry segments – the exception being the enterprise market. Commercially available networking devices are increasingly shipping with DFS capabilities, as embodied in the 802.11h standard.[21] However, the use and growth of DFS is being driven almost entirely by enterprise products and users. Only a small fraction of consumer devices (home routers and mobile access) are DFS-capable, while the majority of enterprise access points are.[22]

When Wi-Fi channels were relatively narrower, it was easier to operate in bands where DFS was not required. However, newer standards, such as IEEE 802.11ac, are optimized to function with much wider channels (i.e., 80 MHz or even broader). As bandwidth grows, the number of channels that can be employed without the DFS requirement may be shrinking accordingly (See Figure 3).[23]

Figure 3: Wi-Fi: As Channels Get Wider, DFS Becomes Unavoidable



Source: Information Week: Network Computing[24]

3.2.5 Dynamic Spectrum Access

The use of databases and DFS techniques can be seen as building blocks toward the goal of allowing sharing on nearly a real-time, fluid basis. Sensing techniques like DFS can be employed to detect the presence of transmissions from another radio and avoid interference. If a radio is able to dynamically shift its use from one frequency to another within a certain frequency range, this can be combined with sensing techniques to enable what can almost be called an "intelligent" – or, as the actual term states, "cognitive" – radio system that will transmit only on unused frequencies

However, if a specific band is congested, situations may occur when there are no more available frequencies to "jump" to for operation of a DSA application. In these cases the lower-priority device it has to switch off and stop providing services to its subscribers. This uncertainty represents a significant limitation to investments.

Cognitive radios have been in development for many years, along with so-called *software-defined radios,* which can be re-programmed to transmit across a broad range of frequencies, with changing power and modulation schemes but without sensing capability. The concept of a fully developed cognitive radio system, however, is still facing lingering obstacles. Foremost among these is the need to communicate within a network. It is not enough for a single radio to sense a potential interferer and hop to another frequency. It must communicate to all other receivers in its network that it is now using another frequency, and what that new frequency is. Those other receivers must notify all other devices to which they are linked, in a cascading fashion. In other words, the entire *network* must be cognitive, and it must shift rapidly and efficiently from one channel to another without losing connection or dropping transmissions. This is clearly a complex engineering task -- one that industry has not yet resolved (See Box 2).

This complexity is further increased by a need to create reliable sensing systems for cognitive radios. For technical reasons, such as hidden obstacles and requirements for very sensitive and expensive receivers, sensing may be not fully reliable to avoid interference. Other sources of information for obtaining knowledge about electromagnetic environment are then necessary.

Meanwhile, the regulatory aspects of dynamic spectrum access are also being discussed and explored, with many implications yet unclear. Is it possible or advisable for DSA to be implemented outside bands particularly set-aside for it? How would it affect different types of radiocommunication services – particularly those with sensitive receivers? How can incumbent users be assured of their primary rights to access spectrum? What will it mean to have global allocations and national licences, if equipment can hop into and out of spectrum bands independently? When (or if) dynamic spectrum access becomes a reality, how can regulators ensure that it will not be abused? How would current licensing models be adapted?

The next section of this paper begins to explore these questions, starting with the last one – regarding adaptation of licensing. For here is where some policy-makers are, themselves, beginning to examine new options and hybrids that may pave the way for more dynamic spectrum usage. The gateway to this experimentation is, as this paper stated out the outset, the need to facilitate spectrum sharing.

Box 2: Efforts to Realize Cognitive Radio System Development[25]

ITU-R's Working Party 5A had a workshop on CRS and white spaces in November 2013. A key point that emerged was that some CRS features currently exist, or are in meaningful development. SPECTRA, a research project in Europe that ran from 2010-2014, successfully developed CRS system protocols and a supporting hardware system, which had a field trial April 23-24 2014. Technical specifications are currently being developed for civilian/commercial use of CRS. *Slides of all the presentations can be found at http://www.itu.int/oth/R0A06000059/en.*

In addition, a 2012 meeting of the South Asian Telecommunications Regulators' Council produced a report on CRS, which had several key findings about the current and future state of the technology:

- "Full Cognitive Radios do not exist at the moment and are not likely to emerge until 2030, when fully flexible SDR technologies and the intelligence required to exploit them cognitively can be practically implemented. We expect basic intelligent reconfigurable CR prototypes to emerge within the next five years. Some devices available already have some elements of CR. Examples include adaptive allocation of frequency channels in DECT wireless telephones, adaptive power control in cellular networks and multiple input multiple output (MIMO) techniques." And indeed, those prototypes have emerged (see above SPECTRA example).

- Current regulatory models are insufficient to properly accommodate CRS technologies; this is in large part because the CRS algorithms would have to be visible to regulators in order to allow them to make intelligent decisions (rather than using power level or frequency constraints as a blunt instrument). This difference between CRS and current "dumb" systems would necessitate a fundamental paradigm shift in regulatory models, as well as a level of transparency from vendors and telcos that may not be readily forthcoming.

  - Technical issue 1: Traditional radios have filters on them to screen out interference before signals are collected and passed along for processing. CRs can't have such a filter, because they need to be able to sense all relevant frequencies, even those that are not actually operating at a particular time. This increases the potential for interference. In addition, interference-screening circuits and software in traditional radios use the radio's frequency and bandwidth settings in their calculations; without those numbers (which are not available for a CR until AFTER such calculations are performed), the calculations are considerably more complex, which again raises the potential for inadequate interference screening.

  - Technical issue 2: The processing power and memory required for a CR unit is much higher than that of a traditional radio, making hardware design and construction more difficult. In addition, the aggregate complexity of an entire system of CRs is much higher than that of traditional radio systems, requiring a more challenging, complicated, and exacting design process for the back-end architecture or the system, and the central control component, in terms of both hardware and software.

3.3 Licensing Innovations to enable greater sharing

With the goal of enabling more – and more efficient – usage of spectrum, regulators have begun to reassess their regulatory tools and embark upon new forms of licensing (including combinations of licensing and unlicensed usage). This is a complicated task, because industry stakeholders invariably wish to preserve or enhance approaches that work for them. For example, licensed operators are extremely reluctant to give up their rights to exclusive use of a set band in a set geographic area, because of the often high price paid to access that spectrum and the ensuing substantial capital outlay for network deployment. Meanwhile, manufacturers of RLAN equipment seek more avenues to develop unlicensed bands that will accommodate a profusion of RLAN uses. The following subsections explore the ways in which previously distinct licensing modes have started to blur.

3.3.1 Operator offloading onto unlicensed spectrum

There are multiple modes for initiating small-cell data offloading. One mode involves the user deciding to initiate the offloading data onto an unlicensed (often Wi-Fi) network with their own smart phones, most of which now come equipped with WiFi capability. Another mode allows the cellular operator to detect impending network congestion and initiate the data traffic offloading, which could be to small cells (e.g., femtocells) or even directly to the Internet through WiFi. This latter, remotely initiated offloading is sometimes known as operator-managed offloading. From a licensing perspective, it is an interesting, if niche-oriented, example of the interplay between licensed and unlicensed networks. In the end, however, it may represent only a short-term solution for users and operators in highly congested areas and markets until more IMT spectrum can be mobilized.

On the last day of March, 2014, the Federal Communications Commission in the United States altered its domestic rules applying to RLAN use of the 5150-5250 MHz band. Among other things, the FCC reduced the previous restriction on indoor-only use of RLAN devices and increased the permissible power, while requiring manufacturers to implement more stringent protections against illegal modifications that could cause interference to other services in the band (chiefly, the Globalstar mobile satellite system). [26] One of the benefits intended in the action, the FCC acknowledged, was to help facilitate wireless "off-loading" of traffic from cellular networks onto unlicensed transmission facilities.

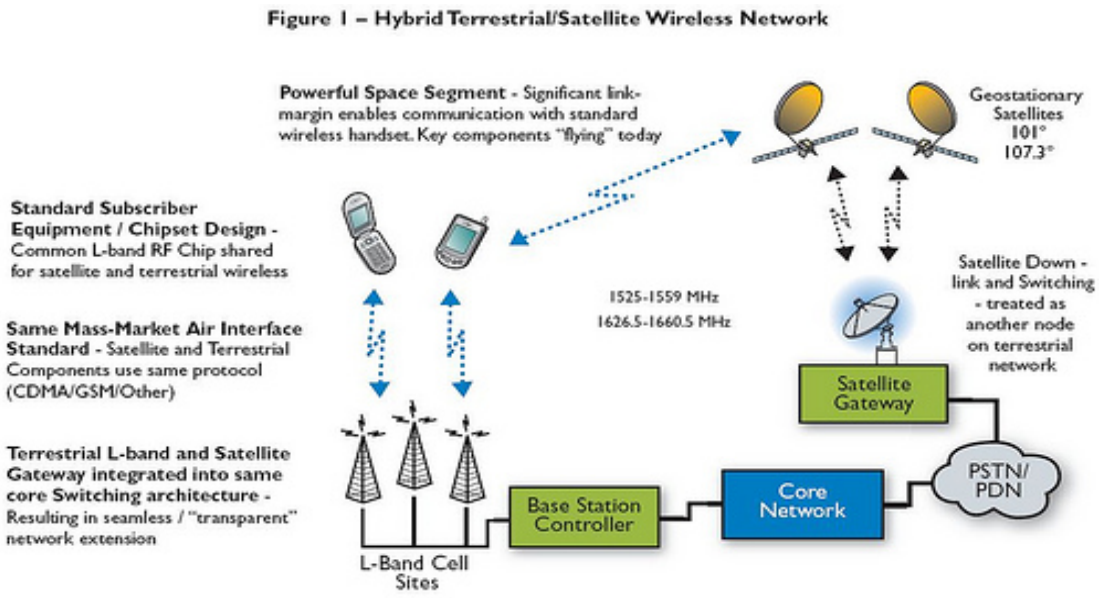
This is an example of how, in at least one economy, pressure is growing to allow greater use of spectrum for unlicensed services. The 5350-5470 MHz band, which is not now authorized for RLAN use, has been proposed for RLAN expansion at the 2015 World Radiocommunication Conference. This would allow RLAN use of a contiguous range of spectrum from 5150 MHz up to 5850 MHz. Notably, however, RLANs would have to share that spectrum with incumbent satellite and radar users, complying with an array of interference mitigation techniques, including DFS and, potentially, database technologies.

3.3.2 Satellite "ancillary" terrestrial spectrum

During the 2000s, mobile satellite service (MSS) providers began to request that regulators allow them to use their licensed satellite spectrum to facilitate terrestrial operations – essentially, to use satellite spectrum for ground-based services in the L-band (1525 – 1559 MHz and 1626.5 – 1660.5 MHz). The MSS operators couched those operations in terms of support for their primary satellite

services, dubbing them an "ancillary terrestrial component" (ATC) that was necessary to fill coverage gaps and provide a more reliable service. In the United States, the FCC agreed – with conditions – and paved the way for what could be viewed as a hybrid satellite/terrestrial network topology using spectrum allocated and licensed to MSS providers.[27] The Commission termed this an "integrated" MSS service with a terrestrial component.

Figure 4: Example Configuration of a Hybrid Satellite/Terrestrial Network (SkyTerra)[28]



Source: http://www.dailywireless.org/2009/08/24/motorola-skyterra-team-for-700-mhzsat-radios/

Opponents of the ATC approach were concerned that it would allow satellite providers to gain a "back-door" entry into the cellular mobile wireless market, but the FCC determined that the ATC operations would not be a functional substitute for licensed mobile service. Thus, the ATC would not enable direct competition with cellular mobile. However, the Commission did establish "gating criteria" – essentially, conditions that the satellite companies would have to prove before being granted ATC authority. MSS operators were then required to apply for permission to operate an ATC component, based on a showing that they met the gating criteria. Essentially, the FCC created a conditional licence extension, across two radiocommunication services, but with case-by-case approval required.[29]

Leasing of MSS(/ATC) spectrum was not allowed until 2011, when FCC changed the rules to allow it. Currently, holders of licences for MSS+ATC services can lease those rights to others, but only in "spectrum manager" arrangements, in which the original licensee takes responsibility for ensuring that the secondary user complies with all the relevant regulations and licence terms. In addition, the secondary user must continue to use the spectrum under the existing rules, meaning that it must be used for an MSS/ATC integrated network function. Subject to these restrictions, MSS-ATC license-holders can lease their spectrum in any geographic or band division they choose. The license-holders must notify the FCC of any leasing arrangement they intend to enter, but unless a public policy issue is raised, approval will be processed immediately.[30]

In the case of WiFi offloading discussed in the previous section, we saw a blurring between licensed and unlicensed regulation of spectrum usage. With ATC and similar hybrid licences, the lines between allocations to previously separate services are being blurred. With ATC (just as with WiFi offloading) the innovation allows regulators retain their licensing authority, to monitor and enforce the operators' behaviour. But the operators gain greater flexibility to use spectrum to meet their broad operational requirements.

However, the advent of MSS/ATC has been clouded by uncertainty. SkyTerra, which was the initial company to apply for and receive ATC authority, was subsequently acquired by Lightsquared, which has run into opposition to its terrestrial broadband network plans due to concerns about potential interference to Global Positioning System (GPS) operations.[31]

We now transition to exploring an approach to spectrum authorizations that draws directly from the ability to utilize database technologies for sharing.

3.3.3 TV white spaces

TV whites space (TVWS) has been authorized in the United States and is the subject of field trials in the United Kingdom and in several countries in Africa (see Section 4.2.2).[32] The approach involves using databases that provide for the protection of TV services under 698 MHz, as well as other licensed services operating in these bands, such as broadcasting auxiliary services (i.e., wireless microphones). The databases can be accessed and updated via the Internet and are maintained by multiple parties on a fee basis.

One of the challenges related to databases, especially for countries with small territories, is coordination of TVWS devices in border areas. This may require exchange of information kept in national databases, since frequency usage, rules and available channels can be different in neighboring countries. Such exchanges may represent significant administrative difficulties. The databases then allow unlicensed network equipment and devices (essentially, part of radio LAN systems such as WiFi) to avoid interference to and from higher priority uses in the band.

Equipment must be designed and deployed to interact with the database and adjust its transmissions as mandated by the data-base. TVWS proponents are requesting that regulations be stabilized so that providers can be certain that the spectrum they are using, on an unlicensed basis, will not be reallocated or auctioned for licensed usage, for example, by cellular mobile providers.

With regard to building an equipment "universe" for TV white spaces, IEEE has been developing a standard for TV white spaces devices, under the rubric of 802-11af – an offshoot of the Wi-Fi suite of standards. IEEE 802.22 is another standard for Wireless Regional Area Networks (WRANs) using TV white spaces.

In terms of licensing, TV white spaces illustrate (like RLANs potentially using DFS at 5 GHz to share spectrum with radars) a combination of licensing and unlicensed strategies. The incumbent users (primarily broadcasters or wireless microphone systems) typically retain existing broadcasting licences. The licensed operators retain primary regulatory status in the band, meaning that they must be protected from harmful interference by the TV white spaces devices. The latter are used without licensing, giving them secondary status (or no status) in the band. That is, the white spaces devices cannot cause harmful interference to broadcasting, and they must accept interference from

the broadcasting or Broadcasting Auxiliary Service (BAS) operations when that occurs. The use of the database, however, enables the TV white spaces devices to operate without either causing or receiving interference to/from the incumbent services.

As documented in a chapter of ITU *Trends in Telecommunication Reform*'s 2013/14 special edition, TV white spaces remain nascent in most parts of the world – and uncertain even where they are operating: in the United States, early advocacy of TVWS in television broadcasting bands has been superseded by an effort to design incentive auctions (See Box 3) that would provide for licences for broadband wireless (while re-farming broadcasters into a smaller spectrum range). It is not yet clear how much spectrum will remain for TVWS usage.

Box 3: The FCC's Broadcasting Incentive Auctions[33]

The U.S. Federal Communications Commission (FCC) has designed an "incentive auction" process to provide market incentives for local television broadcasting stations to release some of their spectrum to be auctioned for broadband mobile services.

The process will involve two "separate but interdependent" proceedings:

- a "reverse auction," in which the broadcasters "bid" the prices at which they would be willing to give up their spectrum, and
- a more familiar "forward auction," in which the mobile providers submit bids for how much they would be willing to pay to acquire it.

The FCC will take both sets of bids, "repack" the entire spectrum range such that the broadcasters who will remain after the auction (those who chose not to participate, or whose sell prices were not met) are located together on the spectrum, and issue the remaining "sold" spectrum to the mobile providers with winning bids.

In other words, the FCC is taking what would be a two-step buyback-and-resell process and making it into a simultaneous auction, in order to allow repacking, and also use information from each auction in the other auction, to allow a closer alignment of buying and selling points. All broadcasters will be affected by this auction proceeding, whether or not they choose to sell, because of the probability that their channel will be changed by the repacking.

3.3.4 Licensed Shared Access

While the unlicensed use of TV white spaces amounts to "swimming at your own risk," it can provide a means for exploiting unused spectrum that would otherwise remain fallow. It does not appeal, however, to cellular mobile operators – at least not as a spectrum strategy for their core voice networks. These operators overwhelmingly prefer to retain their licensed occupation of assigned bands, which the operators have often "paid for" in terms of gaining exclusive rights through auction or tender processes. The operators essentially have paid for the right not to endure the vagaries of database look-ups, saturation of spectrum capacity (often in vital urban areas) – in short, all the potential downsides of unlicensed use.

The problem is that, in an increasing number of countries, the availability of sufficient spectrum that can be cleared, re-farmed and made available for new licences is fast approaching nil. Meanwhile, there remain large ranges and bands of command-and-control assignments still being used by

government departments and agencies, including for public safety, utility or asset management and military defence. What is needed is a regulatory paradigm that could meet multiple needs for spectrum access through shared use, governed by a careful balancing-of-rights management. One proposal to achieve this is *licensed shared access (LSA)*.

Box 4: Defining Licensed Shared Access[34] [35]

The GSM Association (GSMA) defines LSA in the following way:

". . .an individual-license regime of a limited number of mobile network operator (MNO) licensees in a frequency band that is identified for IMT, and which is already assigned to other incumbent users whose spectrum rights of use have not been granted through an award procedure for commercial use, for which the additional users are allowed to use the spectrum (or part of the spectrum) in accordance with sharing rules included in the rights of use of spectrum granted to the licensees."[1]

The European Commission's Radio Spectrum Policy Group (RSPG) has a similar but nuanced definition, which incorporates a clause pertaining to quality of service (QoS). For RSPG, LSA is:

"A regulatory approach aiming to facilitate the introduction of radiocommunication systems operated by a limited number of licensees under an individual licensing regime in a frequency band already assigned or expected to be assigned to one or more incumbent users. Under the Licensed Shared Access (LSA) approach, the additional users are authorised to use the spectrum (or part of the spectrum) in accordance with sharing rules included in their rights of use of spectrum, thereby allowing all the authorized users, including incumbents, to provide a certain Quality of Service (QoS)."[1]

Based on the existing definitions, components of LSA appear to include the following, at a minimum:

- An LSA band would allow continued use by incumbent users, including government users;
- Cellular mobile operators would be able to enter the band, with licences that would be conditioned by technical and regulatory criteria that would allow sharing with the incumbents;
- The terms and conditions for sharing should be implemented by national regulators after consultation (or negotiation) among incumbents and new operator licensees;
- The sharing terms and conditions should allow for all parties to meet standards for QoS or, at a minimum, effective delivery of their services or completion of their missions; and
- LSA should be employed as a complement to, not a replacement for, exclusive allocations and assignments to operators in most bands.

Some descriptions of this concept user the slightly older term, *authorized shared access (ASA)*, and some include provisions for a sensing function, as with DFS or cognitive radio, to allow the non-incumbents to operate. As the LSA/ASA concept evolves, it already is being applied or considered in several regions where re-farming of government spectrum appears to be difficul. These bands and regions are:

- The 2.3 GHz band in Europe, and
- The 3.55-3.65 GHz band in the United States.

3.3.4.1 LSA in the 2.3 GHz band in Europe

In its opinion on LSA, issued in late 2013, the European Commission's Radio Spectrum Policy Group (RSPG) noted a prevailing opinion in Europe that the first practical application of the concept could involve the 2.3 GHz band in 2014.[36] The band (i.e., 2300-2400 MHz) was identified for IMT use at the 2007 World Radiocommunication Conference. However, the presence of other, incumbent users in the band delayed plans by the European Conference of Posts and Telecommunications Administrations (CEPT) to harmonise IMT use across Europe.[37] ETSI called for compatibility studies to determine whether broadband IMT (TDD IMT/WiMAX) could co-exist with the incumbents in the band under a scenario in which there would be five 20-MHz channels.[38] Those studies would include co-channel compatibility, compatibility with incumbents in adjacent bands, and cross-border compatibility.

Studies indicated a mix of compatibility and incompatibility across different countries, ranging from no issues in countries where the band was unused, up to certain countries with government uses, where compatibility might be possible on a shared basis with provisions for protection from interference. The CEPT Electronic Communications Committee (ECC) then sought to develop a decision on harmonized provisions, including LSA procedures, for those situations. That decision was due by mid-2014.[39] In short, countries without problematic issues concerning incumbents might simply allow exclusive-use licensing; where incumbents existed, administrations could implement the harmonized provisions that would include LSA.

3.3.4.2 LSA in the 3.55-3.65 GHz band in the United States

In December 2012, FCC proposed introducing a new "Citizens Broadband Service" in the 3550-3650 MHz band, as a way to allow sharing by small-cell operators without having to re-farm or clear incumbents from the band.[40] An earlier review of 3550-3650 MHz had determined that the only way to share the band otherwise would have been to create large coastal exclusion zones to protect incumbent maritime radars.[41] The required size of those exclusion zones would have made it uneconomic to deploy standard, macro-cell services in the band.

In April 2014, FCC further elaborated on its proposals, developing a three-tiered hierarchy of access to the 3550-3650 MHz band that might be described in terms of LSA.[42] Existing government users and other incumbents would continue to be protected, while the Commission proposed creating a "priority access licence" or PAL that would be offered based on U.S. census tracts. Where more than one applicant existed for a PAL, the licence could be auctioned. Each 10-MHz PAL would be good for only one year, although holders could aggregate extensions of up to five years through spectrum trading. Finally, a general access category would be created in a reserved portion of the band for users who could claim no interference protection. Database technology would be utilized to ensure that lower-priority users did not interfere with PAL holders or the protected incumbents.[43]

The so-called Citizens Broadband Service was not developed overnight, and it still faces an array of doubts: incumbent users within the Federal government have spent years studying and debating with the FCC the potential for sharing this band. Industry observers also question the PALs' auction viability, given their extremely small size and their short duration. The 3.5 GHz experiment will face two core questions: can it foster growth in this band for the small-cell market it hopes to address,

and can it really combine auctioned licences shared with government incumbents *and* opportunistic users? At this juncture, it is too soon to say.

4 International and National developments

Given the current experimentation process with dynamic spectrum licensing and sharing trends, what avenues exist for broader implementation and adaptation? Beginning with TV white spaces, there are both international and national-level efforts to define and codify regulatory guidance and rules (respectively) for this new approach. It is by no means certain that dynamic sharing will work in all cases – much less become the dominant spectrum management technique that some hope it will be. It might only be applied in carefully studied parts of the spectrum, if any other than TV-white spaces are found appropriate on a case-by-case basis.

This section looks at these efforts, beginning with ITU-R developments related to these concepts, and then focusing on experiments, trials and implementation by national regulatory authorities, particularly in developing economies.

4.1 International-Level Developments

WRC-12 addressed the need to review the ITU Radio Regulations (RR) to accommodate new technologies like cognitive radio systems (CRS), but it concluded that no changes to the RR were needed for this purpose. In addition, WRC-12 recognized that while CRS systems are expected to provide flexibility and improved efficiency to overall spectrum use, radio systems implementing CRS technology need to operate in accordance with the RR provisions. Moreover, the use of CRS does not exempt administrations from their obligations with regard to protecting the stations of other administrations that also are operating in accordance with the RR.

The work of the ITU's Radiocommunication sector (ITU-R) on this issue has since continued to be focused on the development of best practices. For this purpose, the relevant study groups and working parties of ITU-R are exploring technical and spectrum management issues. For example, Study Group 5's Working Party 5A[44] has developed a preliminary draft new report on cognitive radio systems, which seeks to define the technical aspects and discuss the applications in the land mobile service that will be made possible once the technology matures and becomes more widely available.[45] This report, which is still pending in WP5A, follows other ITU-R reports and recommendations, including Report ITU-R M.2225, adopted in 2011, which provided an initial introduction to cognitive radio technologies (in the land mobile service).[46] In addition, the same working party held a workshop in conjunction with its November 2013 meeting, bringing together experts to provide a technical update on topics related to dynamic spectrum access.[47]

Box 5: ITU-R Study Group 5's Estimates of Spectrum Requirements[48] [49]

At its meeting in early December 2013, the ITU-R's Study Group 5, which studies terrestrial mobile services (among others), adopted a report on mobile spectrum requirements. According to the report, which had been given initial approval by the study group's Working Party 5D, there was an urgent need to earmark spectrum for mobile cellular services[1] around the world – from 1,340 MHz to 1,960 MHz in any given area, depending on the rate of service growth and the density of market penetration in that country.[1] Moreover, this continent-sized spectrum acreage would need to be found within the bands below 6 GHz.[1]

Any operator of any spectrum-dependent system or device other than IMT or RLANs in this prime spectrum real estate now had to be on notice – if they were not already – that their ongoing access to spectrum resources was now on shaky ground.

The report did not go unchallenged at the meeting. The European Broadcasting Union (EBU) questioned its assumptions, questioned its methodology and, ultimately, sought its rejection by the Study Group. The voice of EBU, a sector member at the ITU, was not supported however, and the requirements will be considered further at the Conference Preparatory Meeting in April 2015as a reference for allocations and identification of frequencies for IMT and RLANs– to be addressed by the 2015 World Radiocommunication Conference in November of next year.

While the working parties of SG5 explore technical aspects of TV white space and cognitive radio in the land mobile service, another working party, 1B, is studying new potential spectrum management principles or approaches and developing best practices in this regard. At its recent meeting, in January 2014, WP1B agreed to establish a Correspondence Group to assist in developing a preliminary draft new Report ITU-R SM.[DYNAMIC ACCESS] on spectrum management principles and engineering techniques for dynamic access to spectrum by radio systems employing cognitive capabilities.

These studies in the ITU-R build on existing Recommendations and Reports that document technology developments, such as software-defined radios, but also well-established spectrum management principles, which are recognized and implemented worldwide and which have proven their ability to accommodate new technologies for decades. These studies, which are ongoing, benefit from the participation of all stakeholders. They particularly take into account the concerns expressed by stakeholders whose services essentially rely on international coordination and cooperation (and who provide benefits to entire international community), such as meteorological, satellite, aeronautical, radionavigation, and Earth observation services.

Many facets of DSA remain unclear, including the following technical and operational issues:

- Required protection of ubiquitously deployed satellite Earth stations that are authorized but not recorded in central databases;

- Difficulty in detecting very-low-power satellite transmissions and implementing systems able to sense such satellite transmissions;

- Protection of aeronautical safety services, which are critical to the safe operation of aircraft, since even minimal levels of interference can put at risk the safety of operational aircraft; and

- Protection of other space services (space-to-Earth) and passive services (radio astronomy, Earth exploration-satellite service and space research service) as well as radiodetermination services.

The need to protect incumbents is an issue not only for sharing in a single band or a given location, but also in adjacent bands or far away from that location.

4.2 National-Level Developments

It may be clear at this point that much of the experimentation in sharing/DSA and new licensing approaches is occurring in the more developed countries with established reputations for exploring unorthodox regulatory options. There are some pioneering efforts taking place, however, in the form of trials (particularly of TV white spaces systems) in developing countries. Some of these experiences are summarized in this section.

4.2.1 TV White Spaces Trial in Kenya

In December 2012, the Communications Commission of Kenya received an application for permission to deploy a trial TV white space network in the country. The Commission responded in August 2013, granting a one-year permit to provide TVWS at two designated rural locations, with three conditions:

- The operators obtain a Network Facilities Providers' Licence at least at a Tier 3 level – or partner with an existing licensee;
- That the applicants operate in the 470-694 MHz band only on a non-interference, non-protected and non-exclusive basis; and
- All equipment had to be type-approved by the Commission before installation and deployment.

The operators were required to deliver a report to the Commission on the performance of the system and its compliance with all conditions. The Commission reviewed the report and decided not to grant, at the present time, an operational licence. This followed some mixed trial results related to the quality of service provided.[50] The Commission described its approach as a cautious one, given the importance of the ongoing broadcasting services.

Box 6: Additional TV White Spaces Initiatives in Developing Countries[51]

Several additional trials and deployments of TV white spaces networks are occurring in developing countries, many of them as part of public-private partnerships or collaborations (see also Section 4.2.2). Some of these are summarized below:

- In the **Philippines**, a partnership involving the government, USAID and Microsoft has developed the ECOFISH project, which uses TVWS technology to deliver broadband Internet access, along with specialized government services and applications, to fishermen in several communities in the island province of Bohol. This will help attain a goal of the government to provide Internet access throughout the country by 2015.
- In May 2013, another pilot project was announced, this time in Dar es Salaam, **Tanzania**. Microsoft partners with the Tanzanian Commission for Science and Technology (COSTECH) and local Internet service provider UhuruOne, utilizing TV white spaces to offer affordable wireless broadband to university students and faculty. The pilot's initial deployment will target the University of Dar es Salaam, among others.
- **Singapore –** the White Spaces Pilot Group (SWSPG) was established in April 2012 with support from Infocomm Development Authority (IDA). The objective of the group is to deploy White Spaces technology pilots in Singapore, thereby accelerating the adoption of White Spaces technologies globally. SWSPG aims to attract broad members from public and private sectors, local and international industry, academic and research institutes and end-user organizations that could benefit from this next generation broadband wireless connectivity.

4.2.2 TV White Space Trial in Cape Town

The Independent Communications Authority of South Africa (ICASA) supported a TVWS trial in Cape Town during six months in 2013. The trial was carried out by a consortium of partners that included Google and the Tertiary Education and Research Network of South Africa (known as TENET), as well as the E-schools Network, the Wireless Access Providers' Association (WAPA) and CSIR Meraka Institute. Multiple base stations were installed at Stellenbosch University's Faculty of Medicine and Health Sciences in Tygerberg, delivering broadband network access to ten schools within a 10-kilometer radius. Although the trial officially ended on 25 September 2013, Meraka recommended to ICASA that the service to the schools be continued.[52]

Testing showed that even during peak periods, average download throughput was above 2 Mbit/s, and off-peak downloads averaged in excess of 10 Mbit/s. Upload speeds during most of the trial varied within a range of just under 2.5 Mbit/s and just over 4 Mbit/s.[53] Moreover, the trial system operated without causing any detected or reported interference to TV receivers in the area.

The concluding report indicated that TVWS could co-exist and share spectrum with broadcasting, and that allowing it would constitute a more efficient use of spectrum. It also recommended developing multiple databases and promoting competition "to drive down costs and spur innovation."[54] More broadly, the organizers advocated promoting an internationally harmonized approach to TVWS device characteristics and certification, a regional approach to spectrum management for TVWS access and the further development of TVWS equipment standards.

4.2.3 Cognitive Radio Test-Bed and Trial in China

Meanwhile, in China, the Beijing University of Posts and Telecommunications has explored TD-LTE technology for cognitive radio systems in two bands: (1) the UHF band (698-806 MHz, and (2) the 230 MHz band. This Chinese approach includes a combination of both database technology and sensing, as a way to build reliability and preclude missed detection of incumbents. The approach involves using a database for "global" or general location of incumbent receivers, and supplementing it with a "local" implementation of cognitive sensing technology.[55] A testbed has been developed for this approach to cognitive radio in the UHF band, and field trials are being prepared in Hebei and Zhejiang provinces for the 230 MHz band.

Based on its experience, the University has developed a list of policy and regulatory challenges associated with cognitive radio systems in their development stage:

- **Policy and Regulation Challenge 1 - Frequency authorization --** Possible frequency band(s) for the systems or services implementing CRS should be authorised first while accounting for existing uses in the band(s).

- **Policy and Regulation Challenge 2 - Frequency allocation --** It is hard to find harmonised dedicated frequency band(s) worldwide or even nationwide. When multiple cognitive cellular systems coexist on the same spectrum band, each of them should have equal right to access the spectrum.

- **Policy and Regulation Challenge 3 – Cross-border coordination --** Radio frequency allocation regulations are different among countries and regions. How to conclude agreement on cross-border coordination related to CRS is a big challenge.

- **Policy and Regulation Challenge 4 - Interference coordination --** To decrease interference risk, regulatory models with clear definitions of rights and responsibilities of both licensed and unlicensed spectrum users are needed.

- **Policy and Regulation Challenge 5 - Type approval --** For reconfigurable devices, the ability to alter operational frequency and transmission modes calls for a new method for type approval.[56]

4.2.4 Additional considerations

It should be emphasized that TVWS and CRS are still new concepts and they remain under study in ITU , in several countries and at a regional level as well. Some trials show a possible use of devices with CRS technology, but only under certain conditions -- in particular a need to operate with a geo-location database. Sensing techniques alone are not sufficient at this juncture.

Moreover, standards for TVWS are under development by organizations such as ETSI and IEEE. Other technical questions relate to spectrum management issues, and even those countries that have already established some national spectrum management regulations covering DSA and related approaches have indicated that these are not definitive and may evolve, taking into account new experiences.

Another area for further work is at the bilateral and multi-lateral level among countries where cross-border issues may arise. Some general principles could already be identified but no detailed answers are yet available. Other issues, which are not related specifically to spectrum management, are about the quality of service and about the comparison between TVWS and other approaches that could provide the same service to the rural areas. These issues need to be discussed at the national level, looking at medium-term and/or long-term perspectives – for example, what would be the most efficient way to bridge the digital divide. In addition the practical aspects of the type-approval process and real-time responses to possible cases of interference (e.g. enforcement) need also to be addressed carefully.

5 Conclusion

For the last ten years (since DFS was introduced), a new paradigm in spectrum management has been gaining momentum. It consists of considering spectrum access as dynamic, rather than static. Taken to its ultimate vision, this new paradigm imagines a dynamic environment in which devices and networks flexibly adapt to constraints in spectrum access with agility and mobility, much the way passengers negotiate a crowded train station or vehicles form lanes on a highway. As with those examples, there would be a set of rules and rights, often built in as software "policy" within the networks and devices themselves. Or, licensing and equipment certification would set the rules, along with coordination and negotiation among classes of users.

The previously identifiable models of spectrum distribution are now evolving into hybrids that respond to the economic needs of telecommunication operators, equipment manufacturers and users. At the same time, these hybrids often retain the administrative and public policy hand-holds that regulators and government users need to fulfill their missions. Meanwhile, new ways of expanding spectrum access are being enabled by developing technologies or licensing approaches intended to ensure coexistence with incumbent spectrum users.

It is important not to lose sight, however, of the fact that core spectrum licensing techniques still function well in a majority of economies and spectrum bands. Regulators need not abandon proven approaches that have worked for their stakeholders, even as they explore potential new departures or hybrids. Some of the new approaches many turn out to be less advantageous or necessary than first thought, and they are likely to evolve further as administrations try new rules and learn from each other.

There is also the potential for unforeseen consequences. Ten years ago, for example, FCC's Part 15 rules for unlicensed use of short-range devices ran smack into a US government mandate that Federal agencies engage in narrow-banding to use spectrum more efficiently. The U.S. Department of Defense shifted some radio operations onto bands that it held as assignments (but had not previously used widely), only to find that these bands were popular with manufacturers of unli-censed wireless garage-door openers. The garage-door openers, being unlicensed, had no rights to claim protection from interference by the Defense Department – but that did not prevent the manufacturers from descending on Washington to plead for relief.[57] It is a parable of how attempts to utilize new approaches to improve spectrum efficiency and sharing can, at times, collide.

For policy-makers interested in pushing ahead to pioneer options for spectrum management, the potential risks seem worth taking. And for the rest of us, they are providing options that can be applied – if and when they mature, and when and where needed. Meanwhile, it will be interesting

to watch and see whether these new sharing experiments really turn out to be new frontiers in licensing, or simply the Wild West.

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[1] *White spaces* previously was known as "TV white spaces" because of the early pioneering of this sharing technique in the UHF television broadcasting bands.

[2] See Voyager Fact Sheet, NASA, http://voyager.jpl.nasa.gov/news/factsheet.html.

[3] See "Exploring the Value and Economic Valuation of Spectrum," ITU-D Regulatory and Market Environment, Broadband Series, April 2012. Available at www.itu.int/broadband.

[4] See Walls, John, "Wireless Spectrum Crisis," commentary in online version of The Washington Post, 20 March 2013, downloaded 17 April 2014 from http://www.washingtonpost.com/sf/brand-connect/wp/2013/03/20/wireless-spectrum-crisis/

[5] See Largent, Steve, "Why Wireless Needs More Spectrum," commentary in *Politico*, 6 February 2013, downloaded 17 April 2014 from http://www.politico.com/story/2013/02/wireless-spectrum-boost-fuels-growth-87272.html

[6] Theoretically, the ultimate result may be the "tragedy of the commons," a situation in which an unregulated resource is subject to overuse, without any mechanism to apportion access equally. The result is constrained access and a degraded resource for all users.

[7] As an example, from the US FCC: "On January 1, 2013, all public safety and business industrial land mobile radio systems operating in the 150-512 MHz radio bands must cease operating using 25 kHz efficiency technology, and begin operating using at least 12.5 kHz efficiency technology. This deadline is the result of an FCC effort that began almost two decades ago to ensure more efficient use of the spectrum and greater spectrum access for public safety and non-public safety users." See http://transition.fcc.gov/pshs/public-safety-spectrum/narrowbanding.html

[8] The U.S. Federal Communications Commission, for example, decided in 2000 to allow all commercial wireless service licensees to engage in partitioning and disaggregation of licenses. It defined those terms as follows: "`Partitioning' is the assignment of geographic portions of a radio license along geopolitical or other boundaries. 'Disaggregation' is the assignment of discrete portions or "blocks" of spectrum licensed to a geographic licensee or other qualifying entity." See Federal Register/ Vol. 65, No. 114 / Tuesday, June 13, 2000 / Rules and Regulations, downloaded 29 April 2014 from http://www.gpo.gov/fdsys/pkg/FR-2000-06-13/pdf/FR-2000-06-13.pdf

[9] ITU and infoDev, ICT Regulation Toolkit, see https://www.ictregulationtoolkit.org/en/toolkit/docs/Document/3274

[10] Ibid, Module 6, section 5.1, "What constitutes an effective regulator?"

[11] See OECD, "Secondary Markets for Spectrum: Policy Issues," Working Party on Telecommunication and Information Services Policies, Directorate for Science, Technology and Industry, DSTI/ICCP/TISP(2004)11/FINAL, 20 April 2005.

[12] See Ofcom "Trading Guidance Notes," OfW513, December 2011, downloaded from http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-trading/tradingguide.pdf.

[13] Kelly, Robert B. and Ann J. LaFrance, "Spectrum Trading in the EU and the U.S. – Shifting Ends and Means," Chapter, Squire Sanders publication, 2012, downloaded 25 May 2014, http://www.squiresanders.com/files/Publication/8ce3ed01-56b5-475a-af16-969ee634df4f/Presentation/PublicationAttachment/9ff7086b-589b-4fdd-bbc6-970717b5837b/Tel12_Squire%20Sanders_ver4.pdf

[14] OECD, Secondary Markets report, p. 5.

[15] See for example, Ofcom UK, "Implementing Spectrum Trading," consultation paper, July 2002, http://www.ofcom.org.uk/static/archive/ra/topics/spectrum-strat/consult/implementingspectrumtrading.pdf

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[27] See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite OrbitMobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, IB Docket Nos. 01-185 and 02-364, Report and Order and Notice of Proposed Rulemaking (*MSS Flexibility R&O*), FCC 03-15, 18 FCC Rcd 1962 (2003).

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[29] According to the U.S. Federal Register, the FCC , responding to a request by Globalstar, "proposed to modify its rules for operation of the Ancillary Terrestrial Component (ATC) of the single Mobile-Satellite Service (MSS) system operating in the 2483.5-2495 MHz band [i.e., Globalstar]. The proposed rule changes would allow the MSS operator to deploy a low-power terrestrial broadband network that would operate in both Globalstar's licensed spectrum at 2483.5-2495 GHz, and, with the same equipment, spectrum in the adjacent 2473-2483.5 MHz band used by unlicensed devices."

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GSR discussion paper

The impact of data on ICT business models

Work in progress, for discussion purposes

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The economic influence of data and their impact on business models

Authors: Dr René C.G. Arnold & Dr Martin Waldburger (WIK Consult)

Executive summary

An increasing number of devices that collect and transmit data have been improving access to data. New data transport, storage and analysis procedures have been enabling more and more businesses to utilise data in their business models. This indicates a trend towards data becoming a new driver of economic growth. In light of this development, this paper first traces the evolution of business models built around data and it finds evidence for a sustained structural change leading to a data-driven economy that policy-makers and regulators need to be alert to. Hence, a structural approach to analyse this economy and its development is devised: the data value circle. When applied to analyse the market size and prospects for each of its parts, three important characteristics of the data-driven economy emerge. First and foremost, this first analysis underlines data's economic influence stretching across almost all sectors. Second, it is found that the data-driven economy is shaped by two-sided markets that seem prone to create dominant positions in the market and thus should be monitored by policy-makers and regulators – especially since, third, the analysis indicates that it is still uncertain which players will win the most powerful position.

This last finding merits a closer investigation of business models, strategic options and emerging challenges in the data-driven economy. Thus, this paper analyses five key value propositions and surrounding business models: (1) Mobile device ecosystems; (2) Connectivity; (3) Cloud services and content delivery networks; (4) Targeted online advertising; (5) Video streaming. From these analyses, strategic options of market players and emerging challenges for all stakeholders were identified. Finally, the paper sketches potential avenues for policy-makers and regulators in response to these challenges. The following challenges and potential responses represent the main findings of this paper:

Independent from their position in the data value circle many actors aim to gain a foothold or even control in additional parts of the data-driven economy. If they are successful, they might be able to gain a dominant position and may be able to exert it to hamper competition. On the other hand, such a dominant position would grant them access to data that would allow full profiling and potentially may lead to concerns as privacy and data security. Policy-makers and regulators should be aware of this trend and closely monitor it.

Instead of entering other market segments themselves, the paper shows that partnerships can be a powerful way to build successful business models. Such partnerships may be an attractive avenue for OTTs and operators, for instance, as regards preferential treatment of specific OTT services that can increase the operator's value proposition. Such partnerships may lead to quasi managed services for some OTTs in some networks and they deserve the attention of regulators to ensure sustained fair competition.

Due to the value that data hold for successful business models today, there are strong incentives for all actors in the data-driven economy to collect as much data as possible. Consumers are often unaware about if and which data are collected about them and what happens with these data. More often than not, they cannot make informed decisions. Policy-makers should take steps to enable consumers to such informed decisions. First and foremost, it will be necessary to find out how consumers conceptualise personal data and what terminology they use. This will enable effective information and more transparency for consumers. Next to information and transparency, one may also consider steps to enable consumers to access the data that, for instance, OTTs and operators have about them.

Finally, it became obvious that the data-driven economy is very much a global economy. Thus, all the above interventions may have little effect if they are only applied on a national level. In essence, the structural change towards a data-driven economy calls for internationally agreed responses by policy-makers and regulators. Consensus needs to be reached regarding governance, the organization of the process, implementation, enforcement, and cooperation for all major policy actions that may be necessary to ensure an overall positive economic effect of this structural change.

1 Introduction

With the spreading of digitization and the Internet as well as the evolution of devices connected to it, the ability to collect, analyse and utilize data has made huge leaps recently. Numerous, often innovative business models ranging from data transport and data storage to sophisticated data analysis as well as insights creation are based on revenues essentially gained from data. This indicates a trend towards data becoming a new driver of economic growth and their significant impact on business models. The present paper will therefore start by tracing technical innovations that have enabled better access to as well as transport and utilization of data. Each of these innovations has triggered new business models that ultimately result in a sustainable ongoing structural change resulting in a data-driven economy that policy-makers and regulators need to be alert to.

Data have gained economic influence far beyond the 'traditional' ICT-actors. For instance, pharmaceutical, biological and chemical research and development has become very much data-driven. Cars feature Internet connectivity collecting and analysing data to provide safety and comfort functionalities. Home appliances become 'smart' by being aware of their environment and reacting accordingly based on data. On the other hand, these data have to be made accessible to the end user. They have to be transported and handled. Otherwise, no meaningful services based on data can be developed nor successfully applied. As policies and regulation have a significant impact on whether all these value propositions can work hand-in-hand and initiate positive economic effects, policy-makers and regulators need to understand the interrelations of different actors. To this end, this paper develops a structural framework of the data-driven economy by defining stakeholder relationships – the data value circle. It also highlights some of the key characteristics of the data-driven economy such as two-sided markets that already hold some policy implications. Building on this structure, it is important to recognise the economic importance and projection of each sub-market and the role it plays for the ongoing structural change. This paper will therefore briefly analyse each segment in the developed structure.

Besides cutting across numerous sectors, the data-driven economy shows some other rather uncommon features:

- Data unlike most other economic factors become more valuable with increasing availability.
- Consumers often pay with their data not their money, but seem to be largely unaware of this.

In light of these characteristics, the paper sets out to analyse specific value propositions within the data-driven economy as well as the business models that surround it. This part of the paper will emphasise the functioning of business models, their profitability and the strategic options they enable. Emerging challenges for actors within the data-driven economy as well as policy-makers and regulators will be identified.

In fact, various challenges may emerge from the business models in the data-driven economy and the strategic behaviour of its stakeholders:

- Strong incentives to gather more and more data about consumers have to be balanced out with consumers' interests and privacy.
- Increasing data traffic needs to be dealt with in an efficient and fair manner to all competitors.
- Consumers need transparency and empowerment as regards their own data.
- Effective solutions have to be brought forward to clarify and simplify jurisdiction across borders that can cope with the global nature of the data-driven economy.

These and other challenges identified throughout the paper will be summarised and potential avenues for policy-makers and regulators will be sketched at the end of this paper.

Section 2 traces the development of technical innovations and business models in general that have led to the data-driven economy as we see it today. Section 3 develops the data value circle as a structural

framework of the data-driven economy that allows a more in-depth understanding of the individual segments as well as their interrelations. It also provides a first analysis of the value of the data-driven economy exploring the market size and market development for each segment in the structure. Section 4 selects and analyses key value propositions and their surrounding business models from the data-driven economy for in-depth analyses. Within that the emphasis is put on the profitability and potential strategic options these business models enable as well as challenges that may emerge from these options for both actors in the data-driven economy, policy-makers and regulators. Finally, Section 5 pulls together the insights gained in the paper, summarises the challenges that may emerge and sketches avenues for future policies and regulation in light of anticipated strategic behaviour of stakeholders in the data-driven economy.

2 The evolution of the data-driven economy

This section aims to trace how technical innovations have made it possible to collect, analyse and utilize ever increasing volumes of data and how this has triggered a process of structural change building on data as the driver of economic growth. Starting with the first computers and early networks, the evolutionary paths to a data-driven economy can be split into four phases that revolve around the evolution of the World Wide Web:

- Phase 1: The commercialisation of the World Wide Web

Access to data has gone through significant changes during the late 20th and early 21st centuries mainly due to the invention of the computer. As soon as the 1960s, early forms of computer networks developed, which can be considered the predecessors of the Internet and World Wide Web as it is known today. The latter began to evolve in the early 1990s. At first, the few websites that existed usually provided information from public institutions or followed largely altruistic motives. The commercialisation of the Internet commenced with the Global Network Navigator (GNN), which was the first site that generated revenues through online advertising. The dominant trend at that time, however, was to transfer traditional brick-and-mortar business models into the online world. For instance, Amazon and Ebay started their online presences in 1995.

- Phase 2: The "seek and find" growth phase of the World Wide Web

With the amount of data available on the World Wide Web increasing dramatically over the next years – the number of websites increased from 10,000 in 1994 to 650,000 in 1997 – a need was created for a more convenient way to navigate the web as compared to the ever more crowded directories common at that time. This led to the first business that can be considered data-driven in the sense of the present paper, i.e. search engines. Their main purpose was to offer users a free, quick and reliable way of finding their way through the Internet. On the other hand, they were able to sell online advertising to businesses that soon was individualised by adapting to the keywords entering in the search field. Thus, it offered a much better targeting than other forms of advertising. To improve their service to businesses that pay for these advertisements, search engines providers have started to collect more and more data about their users. In essence, data have become the pivot of their business models today. They need to be able to analyse large volumes of data quickly to provide a satisfactory search service and match the online advertising accordingly. On the other hand, they have to collect, analyse and understand data about consumer behaviour to offer the most competitive service to their paying customers.

- Phase 3: The "always on" growth phase of the World Wide Web

The advent of broadband connections and flat rate charges in the 2000s increased the importance of data as it enabled consumers to be 'always on' and the use of data intensive services. As regards business models that profited from these developments, the most prominent examples include social networks (e.g. Facebook, MySpace), file sharing services (e.g. Napster) and messaging (e.g. ICQ) as well as video telephony (e.g. Skype). The first examples rely heavily on online advertising to monetise the services they offer for free to the public. Therefore, they are also keen to collect and analyse user data. For the latter,

digitised data have presented a way to enter markets that formerly were controlled by network operators.

- Phase 4: The "on everywhere" and "seamless integration" phase of the World Wide Web

The introduction of the IPhone in 2007, the first smartphone, and its revolutionary user interface building on so called apps available through the Apple iTunes AppStore, which was swiftly followed by others, added 'on everywhere' to the already existing 'always on' culture. Mobile devices in particular are always in standby, always physically close to the consumer and with the app-inspired user interface the threshold of using the device and going online has fallen dramatically. This has increased the volume and value of data that can be collected about consumers and their behaviour. In turn, these data enable new kinds of business models that are able to offer even complex services to consumers seemingly free of charge. Whilst some of these business models are very profitable (e.g. Google and Facebook), many competitors struggle to monetise their services sustainably (e.g. Twitter, Spotify, Pandora). Next to advertising-based business models, some subscription-based ones seem to be successful as they managed to adapt quickly to the multi-device environment (e.g. Netflix).

In sum, this evolutionary path reflects the growing influence that data have been having on the economy. In phase 3, messaging and telephony services based on data have started to substitute messaging and voice services offered by network operators. In phase 4, music and video streaming services begin to enter the business of traditional media companies. Apps realise mobile services from various sectors everywhere and consumer data have become a key resource in the fight for advertising investments. Recently, one observes that continuously, new types of devices connect to the Internet, collecting and transmitting data that supports or initiates new business models in many sectors. In essence, this indicates a structural change towards a data-driven economy that is likely to affect all economic sectors. Within that interrelations between the individual groups of actors have to be clarified and the prospects for individual parts of the market should be investigated to evaluate their relative weight within the data-driven economy. The following section therefore aims to develop a structural framework of the data-driven economy that enables an in-depth understanding of these issues.

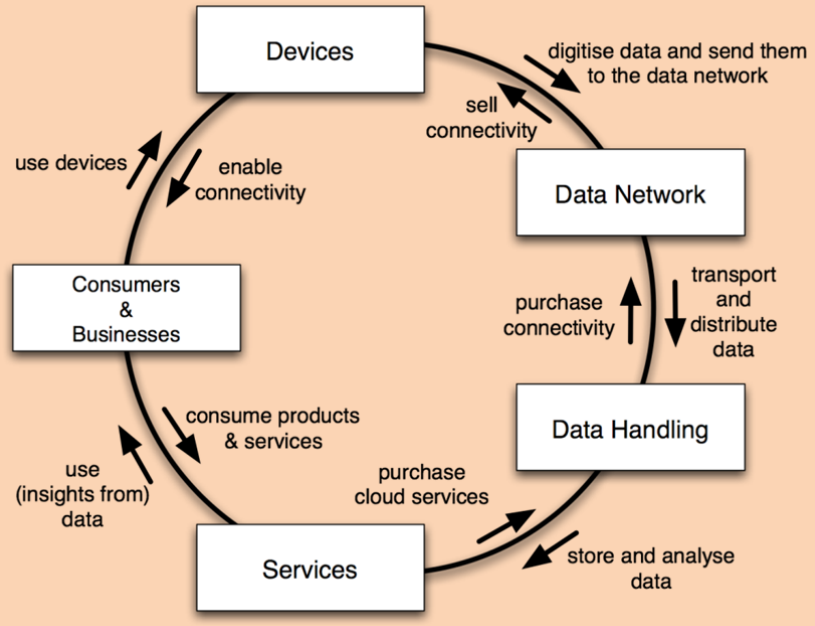
3 The structure of the data-driven economy – the data value circle

A structured approach to defining the individual groups of actors within the data-driven economy is missing thus far. The first section here develops such an approach – the data value circle. The following section investigates the size of the market and the prospects for each group of stakeholders. This will help policy-makers and regulators to recognise the importance of the shift that is going on. Furthermore, for each group of stakeholders, key insights will be derived that either characterize their role in the data value circle in more detail or highlight potential challenges that need to be addressed by complimentary policy or regulatory actions. Such measures will be sketched in Section 5 based on the identified challenges. The final Section 3.3 summarizes general characteristics of the data value circle that emerge from the preceding sections and that will aid to contextualise the challenges identified before as well as the following business model analysis.

3.1 The data value circle

The first and most obvious difference of the data-driven economy as compared to traditional sectors is the form of its structure. It is not characterized by a simple linear value chain that has a defined start and endpoint. Rather, the data-driven economy has to be thought of as a value circle. The actors found in each segment can interact forwards and backwards with other actors in the circle. The data that is exchanged and monetised throughout the value circle originate from consumers and businesses. Consumers and businesses also constitute the end users of services based on these data. Figure 1 provides an overview of the data value circle.

Figure 1: Data value circle



Source: WIK-Consult (2014)

On the one hand, the consumers and businesses which comprise the data value circle produce digitised data by utilizing devices.

Data can be produced consciously by consumers and businesses (e.g. by typing a letter) or unconsciously (e.g. by moving around with a mobile phone in their pocket that tracks their movements). On the other hand, consumers and businesses consume services that are ultimately based on the data they have produced in one way or the other. Next to digitizing data, devices also transmit these data into the network. They therefore fulfil an important function in the data-driven economy. Data networks transport and distribute these data most commonly to providers of data handling such as cloud services or content delivery networks, who support both providers of data networks as well as providers of data based services. This final segment of the data value circle is the one most discussed in the public. Most OTTs offer services and products based on data or insights stemming from data to consumers and businesses. Such services include, for instance, audio and video streaming on the one hand, but also targeted online advertising that more often than not serve as the major source of revenue for these companies.

The following sections investigate the market size, revenues gained in the market, and the potential development of the market for each of these actors or market segments in turn.

3.2 Market analysis along the data value circle

3.2.1 Devices as part of the data-driven economy

Devices within the data-driven economy enable data gathering and data transmission into the network. They constitute a necessary precondition for any consumer or business to connect to the Internet and use services offered digitally. Such devices can be stationary as well as mobile. For instance, they include naturally PCs, laptops and mobile phones as well as tablets, but also stretch to other things like cars with built-in infotainment and security appliances, home automation systems or refrigerators. Next to the distinction between stationary and mobile, it is also important to look at how these devices produce data namely with or without human interaction. For instance, PCs, laptops and phones require human interaction to produce data at least once when you agree that certain data may be tracked and send from

e.g. your phone. Cars or home automation systems often have built-in data gathering and transmission functionalities to provide comfort or safety functions; in some cases the consumer may be unaware if, which and how much data are collected. Most often, he or she cannot opt out if comfort or safety functions are to be used. Independent from the awareness of the consumers, the data brought into the data value circle by mobile devices and in particular mobile phones appears to be especially valuable due to their physical and psychological proximity to their users.

The number of devices connected to the Internet ultimately defines the market size of this segment in the data value circle. This number is growing fast. This is true for both "traditional" ICT-devices such as PCs, laptops, mobile phones and tablets as well as more unconventional ones like cars, watches or home equipment. Turning to "traditional" ICT-devices first, one clearly recognises a strong and ongoing trend towards mobile used to access the World Wide Web. In fact, mobile devices are likely to become the most important access point to the Internet for the next few years. They are much more widespread than PCs or laptops with fixed access already today and their numbers are still increasing sharply. Furthermore, in most developing countries they are often the only way to connect to the Internet. Many other devices that collect and transmit data are also mobile, for instance, cars with infotainment or safety functionality, smart watches or wristbands. To discuss the whole breadth of products that can be subsumed under the flag of the data-driven economy would certainly go beyond the scope of this paper. However, the number of devices connected to the Internet as registered by Cisco's Connections Counter[1] is certainly indicative for the trend that more and more products rely critically on an Internet connection and offer enhanced functionality through data. In May 2014, there were substantially more than 12 billion connections counted by Cisco, who expect this number to rise to 50 billion by 2020.

Despite the multitude of types of devices and stakeholders, it is surprising that a key enabling part of devices – their operating system – is controlled by only a handful of players. The leaders in this market are Google (Android) and Apple (iOS). Both of them have made steps to extend their influence into e.g. cars by joining up with car manufacturers and suppliers, homes by set-top boxes or thermostat appliances or wearables like smart watches.

This first general investigation of devices as part of the data value circle generates the following insights:

- Devices play a key enabling role in the data driven economy.
- Consumers may often be unaware of whether, which and how much data are collected about them.
- Many stakeholders produce and sell devices; however, very few control key components of devices such as their operating system.
- The importance of devices within the data-driven economy is likely to grow as more and more devices connect to the Internet entering all areas of our lives.

3.2.2 Data networks in the data-driven economy

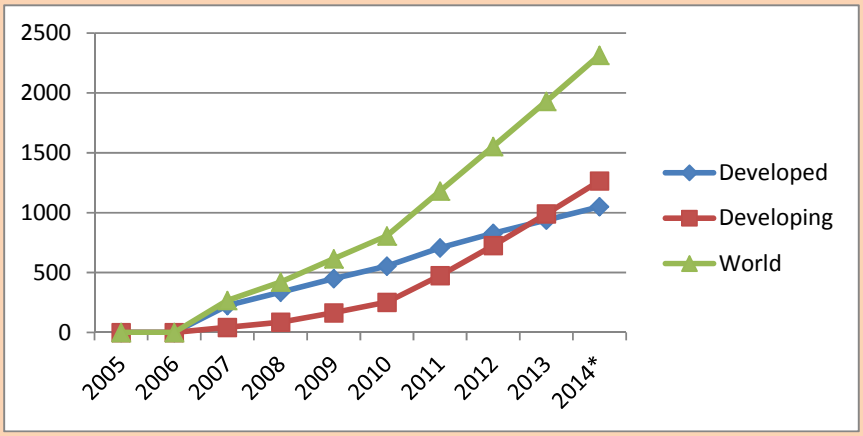
Data networks are at the heart of the data-driven economy. They transport the data that devices produce and distribute them. Connectivity can be provided either as fixed line access or mobile access to the end users and is commonly converged to a fixed access when transmitting data to those who have specialised in handling data.

[1] Cisco (2013): Connections Counter: The Internet of Everything in Motion, available at: http://newsroom.cisco.com/feature-content?type=webcontent&articleId=1208342

A strong indicator for the size of the relevant market is the number of broadband subscriptions that potentially can bring data into the data value circle using the numerous devices that can collect and transmit data. The following paragraphs will therefore analyse the development of mobile as well as fixed broadband subscriptions worldwide.

ITU numbers[2] for mobile broadband subscriptions show for 2014 an estimated continuation of the constant growth observed since the mid-2000s (see Figure 2). A continued path of subscriber growth is expected for both developing and developed countries, whereas subscriber numbers in developing countries have surpassed those in developed countries in 2013, plus the growth rate in developing countries is significantly higher than in developed countries. In 2014, more than 2.3 billion subscriptions worldwide will be reached. This reflects a penetration rate of close to 32 %. Ericsson's research looks further into the future and predicts 5.1 billion mobile broadband subscriptions by 2017[3].

Figure 2: Mobile broadband subscriptions in millions



Source: ITU World Telecommunication/ICT Indicators Database (2014)

The outlook for fixed broadband subscriptions (see Figure 3) looks similarly positive according to ITU figures (numbers for 2014 estimated). Although both the absolute amounts as well as growth rates of fixed subscriptions are lower than for mobile broadband, an outlook of further growth in the next years appears realistic. Year-over-year growth rates from 2013 to 2014 are at around 5.6 % worldwide (3.7 % in developed and 7.4 % in developing countries).

Despite increasing market size, it is often asserted that network operators have difficulties with decreasing ARPUs that fail to recover the costs inflicted by increasing volumes of data traffic on their networks. Obtaining revenue figures that capture the full market is not possible to the knowledge of the authors. Thus, the following paragraphs build on the mobile revenues of two prominent examples of network operators: AT&T and Bharti Airtel.

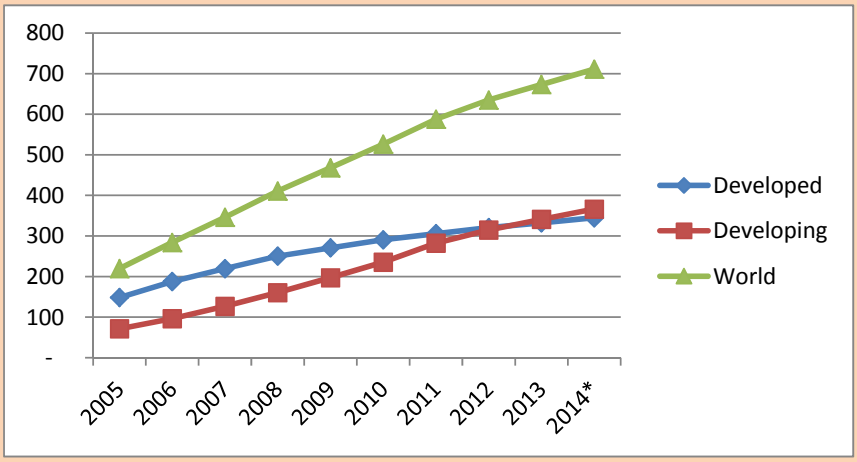
[2] ITU (2014): ITU World Telecommunication/ICT indicators database, available at: http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2014/ITU_Key_2005-2014_ICT_data.xls

[3] Ericsson (2012): Traffic and Market Report 2012.

AT&T was able to keep the overall ARPU almost stable from Q2/11 to Q2/13[4]. Within this period data ARPU increased, whilst voice ARPU decreased. Bharti Airtel was able to double its data ARPU from Q1/12 to Q1/14[5]. Voice APRU remained stable over this two year period. However, in the same period, data usage per customer increased also constantly – and significantly – in every quarter reported. The comparison of quarterly growth rates for data ARPU on one hand and data usage on the other hand reveals that data grew in most quarters faster than data ARPU (see Figure 4).

In essence, the two considered cases of AT&T and Bharti Airtel India show that overall ARPU does not necessarily decrease – it seems at least possible to keep it at comparable levels. Data ARPU was observed to increase nearly every quarter, which indicates that data business gains – and will probably continue to gain – even more relevance in the future. However, the faster growth of traffic volume than data ARPU may develop indeed into a significant challenge for sustainable profitability.

Figure 3: Fixed broadband subscriptions in millions



Source: ITU World Telecommunication/ICT Indicators Database (2014)

On the other hand, network operators may be able to compensate for a part of this trend by falling acquisition cost of IP transit traffic. TeleGeography research into monthly IP transit prices from Q2/08 to Q2/13 indicates that "10 GigE port prices have decreased at a compound annual rate of 28 and 30 percent"[6]. Price levels differ, however, significantly. Whilst prices in London have come down from 13 USD per Mbps on a 10 GigE port in 2008 to around 1.50 USD in 2013, prices in e.g. Sao Paolo are at around 20 USD still in 2013. Another means to compensate for fast growing traffic volumes for a network operator is to circumvent IP transit traffic by means of typically cost-free peering traffic whenever

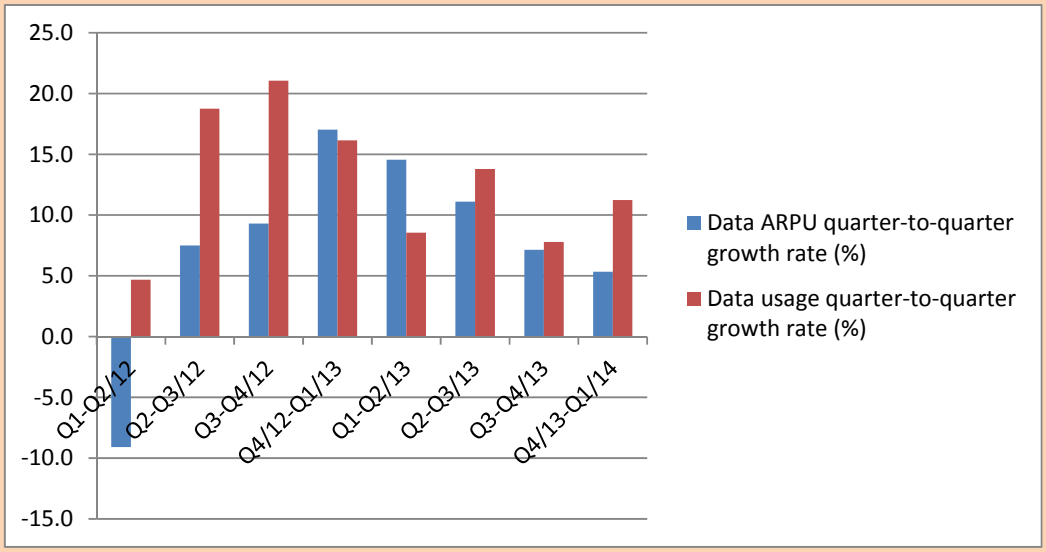
[4] Network Strategies: LTE vs ARPU – data takes over. Available at: http://www.strategies.nzl.com/wpapers/2013014.htm

[5] Bharti Airtel Quarterly Reports (2012-2014)

[6] TeleGeography (2013): IP Transit Port Upgrades Yield Steeper Price Declines for Buyers, available at: http://www.telegeography.com/press/press-releases/2013/10/08/ip-transit-port-upgrades-yield-steeper-price-declines-for-buyers/index.html

possible. The industry blog Dr. Peering forecasts[7] that most network operators will be able to extend their peering traffic to a level of about 25 % of their total traffic in 2015.

Figure 4: Comparison of quarterly growth rates for data ARPU and data usage (2012 to 2014) for Bharti Airtel India



Source: WIK-Consult, Data: Bharti Airtel Quarterly Reports (2012-2014)

In essence, this first analysis of the field of data networks within the data-driven economy results in the following insights:

- Growth in mobile devices connected to the Internet is reflected by a growth in mobile subscriptions worldwide extending the market for actors in the data networks segment of the data value circle.
- Data traffic is growing within fixed and mobile networks around the world and is likely to drive revenue for actors in the data networks segment of the data value circle.
- Data is a driver of costs. Although there are ways to circumvent potentially shrinking profits, in the long term the growth of data traffic may still pose a risk to actors in the data networks segment of the data value circle.

3.2.3 Data handling within the data-driven economy

Data handling includes all services that facilitate data distribution, storage and analysis. Within the data-driven economy, this refers to content delivery networks, cloud computing including infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) and Big Data analysis. With growing data volume produced by devices, data traffic on data networks and more and more services

[7] Dr. Peering (2013): 2014 Transit Prices and Peering Projections, available at: http://drpeering.net/AskDrPeering/blog/articles/Ask_DrPeering/Entries/2013/10/25_2014_Transit_Prices_and_Peering_Projections.html

seeking to use these data, it only seems natural that also the size of the market for all kinds of data handling increases.

It is, however, difficult to pin down a number to the actual size of market as it is constantly evolving. Thus, this section slightly diverges from the common structure and describes only the development of revenues in this segment of the data value circle. The analysis of revenues first considers providers of cloud technology and services and then looks at providers of Big Data analyses.

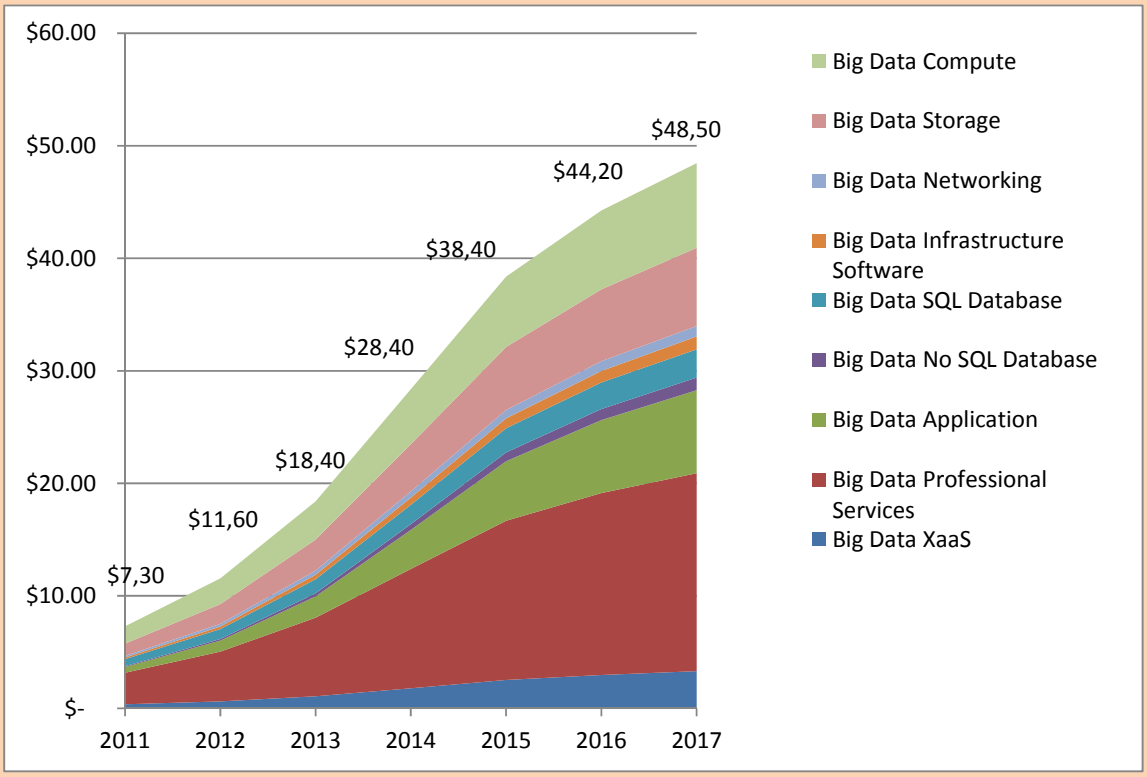
Publicly available insights into revenues for cloud technology and services are scarce. Synergy Research[8] estimate that the worldwide revenues for all cloud infrastructure services surpassed 12 billion USD in the fourth quarter 2012 growing 15 % from 2011. They predict that these revenues will grow more than six fold until 2017 accounting to more than 75 billion USD.

Within the market of cloud infrastructure services CDNs/ADNs contributed 11 % to revenues in 2013 (approx. 1.4 billion USD). The largest share was contributed by managed hosting (45 %) and collocation (29 %). The strongest growth, however, was identified for PaaS and IaaS (over 50 % YoY). Synergy Research Group expects these two cloud services to show a CAGR of more than 25 % until 2017. Next to infrastructure related services, SaaS is seen as the major driver of growth for cloud services. Forrester Research[9] report it at a revenue of 33 billion USD in 2012 and project that it will surpass 100 billion USD in 2017 reaching 134 billion USD in 2020.

[8] Synergy Research Group (2013): Cloud Infrastructure Services: Market Primer.

[9] Forrester Research (2011): Sizing the Cloud – A BT Futures Report. Understanding And Quantifying The Future Of Cloud Computing.

Figure 5: Big Data worldwide revenue 2011-2017 by types in billion USD



Source: Wikibon (2013)

Big Data services build on technology optimized for the handling of large quantities of data very quickly. For instance, such systems build on in-memory processing architecture like SAP's HANA or IBM BLU Acceleration. Big Data services are in high demand as businesses turn to Big Data more often to gain business intelligence and to make business decisions. Other applications can be found in the biological, chemical and pharmaceutical research. Estimating the market size of Big Data technology and services delineated from cloud infrastructure services is difficult as there is some natural overlap in the figures. IDC[10] estimates that worldwide revenues were just shy of 10 billion USD in 2013 and will grow to almost 17 billion USD in 2015. Particularly high growth rates are foreseen for storage (CAGR 61.4 %), networking (CAGR 42.4 %) and services (CAGR 39.5 %). Wikibon foresees even stronger growth in the field of Big Data (see Figure 5). They estimate the market size in 2014 at 28.4 billion USD and predict it to grow to 48.5 billion USD in 2017. Given the overlap with cloud infrastructure services in general, it can be assumed that in particular Big Data will be the major driver of growth in the field of data handling.

In sum, three insights can be drawn from the general analysis of data handling within the data-driven economy:

[10] IDC (2012): MARKET ANALYSIS: Worldwide Big Data Technology and Services Forecast 2012-2017

- Growing numbers of devices, resulting growth in data traffic load and increasing demand for services such as Big Data analyses from providers of data-based products and services (see next section) lead to increased demand for data handling.
- Data handling constitutes a critical supply function within the data-driven economy.
- Big Data is the major driver of growth in this field.

3.2.4 Services within the data-driven economy

Services in the data-driven economy can be understood as all services that build on digital data either in form of data gathered from consumers and businesses or digital content being distributed. Such services stretch to services aimed at consumers like social networks, IPTV, video and audio streaming or (mobile) applications as well as services aimed at businesses e.g. online advertising, business intelligence or market research. The following paragraphs will first shed light on different approaches to monetize services. Hence, the market size for each of these markets is analysed based on user and revenue figures.

Many services in the data-driven economy are offered for a marginal or even free of charge to the end user (usually consumers), but are monetized through offering services to other businesses like targeted online advertising or market research insights. On the other hand, there are also a substantial number of services that are offered on a subscription-based revenue model. Most commonly, these are video and audio streaming services showing premium content, dating services or news-related services. Additionally, one can identify hybrid revenue-models relying on a mix of fees and secondary monetization. Consequently, it is difficult to identify a single measure that would capture the development of the services market in the data-driven economy fully. Nonetheless, some indications as regards market size and development can be drawn from the figures presented in the following.

Indicators relating to usage of data-driven services are one way of understanding the market size for such services as well as their future development. All the examples of services mentioned in the above show increasing usage and analysts foresee further growth. Social networks have been adopted by users faster than any other innovation before. The most prominent examples, Facebook, Google+ and Twitter currently feature >1.2 billion, >500 million and >230 million users respectively. This is a trend that is certainly not limited to the developed world. For instance, Facebook has more than 50 million users in African countries[11]. Also the Chinese are very active on their own social networks Renren, Tencent Weibo and Qzone as well as Sina Weibo. E-marketer[12] foresees the worldwide number of users to climb to 2.33 billion in 2017 indicating declining growth rates over the next three years. Digital TV Research[13] shows at the end of 2013 already 88 million IPTV subscribers globally. They predict this number to almost double by 2018. User numbers for video and audio streaming are difficult to identify as most of these services offer a free and a subscribe option. For video streaming, Netflix is probably the most notable example. Its user base has increased from 34.2 million in Q1/13 to 47.8 million paying subscribers in Q2/14[14]. For music streaming, ABI Research[15] estimate the worldwide subscriptions to have reached 29 million at the

[11] SocialBakers (2014): Facebook statistics, available at: www.socialbakers.com

[12] eMarketer (2013): India Leads Worldwide Social Networking Growth, Country set to control largest Facebook population worldwide, available at: http://www.emarketer.com/Article/India-Leads-Worldwide-Social-Networking-Growth/1010396

[13] Digital TV Research (2013): Global IPTV Forecasts.

[14] Seeking Alpha (2014): Netflix: A Stock With Upside Potential. Available at: http://seekingalpha.com/article/2201453-netflix-a-stock-with-upside-potential

[15] ABIresearch (2013): Spotify to Hold 32% of 29-Mil. Music Streaming Subscribers Forecasted for End-2013, London, available at: https://www.abiresearch.com/press/spotify-to-hold-32-of-29-mil-music-streaming-subsc

end of 2013. The number of consumers using the free version of these services ranges between four- and six fold the number of subscribers depending on the service[16]. Mobile apps are even more difficult to grasp as only part of their services qualify as data-driven in the sense of the present paper. Mobile apps are most often only another channel for stakeholders from sectors outside the data-driven economy to offer their services such as travel services, e-commerce or infotainment. Some apps like the mobile versions of social networks, messengers and guiding/rating apps rely heavily on user data, whilst the online versions of video and audio streaming services draw a great load of traffic into mobile networks. A constantly increasing number of smart phones as well as available apps let this market grow over the next years.

Analysing corresponding revenue figures as it has been done in the sections for the other segments in the data value circle makes relatively little sense due to the two-sided nature of many data-driven services described in the above. The other side of the services market in the data-driven economy, which mainly consists of offering targeted online advertising to other businesses, however, highlights the financial impact of the growing adoption of such services. The following paragraphs will therefore focus on this aspect.

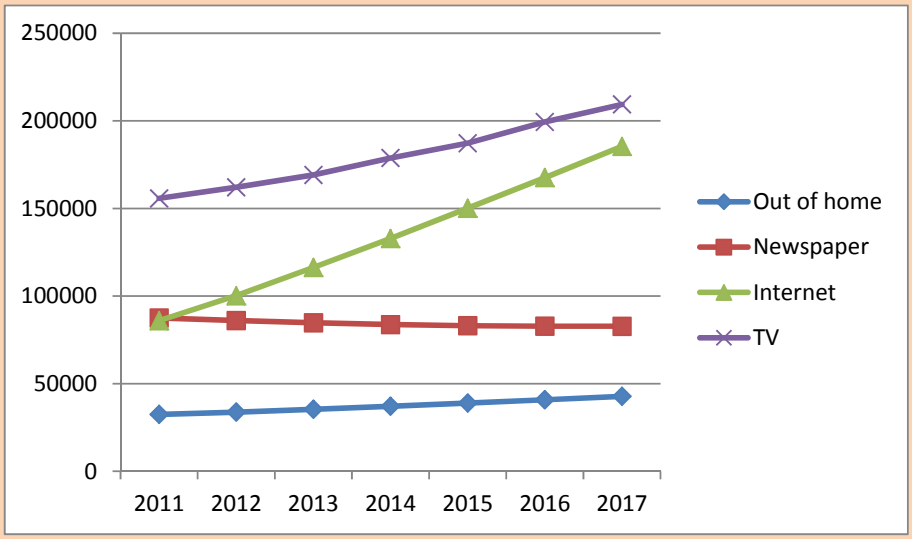
A PwC report on behalf of the interactive advertising bureau[17] illustrates the financial impact of online advertising in the United States – probably the most important advertising markets worldwide (see Figure 6). Here Internet advertising totals at 42.8 billion USD of revenue in 2013 (+17 % YoY) with further growth to be expected. On the other hand, broadcast and cable TV, which represent similar revenues (40.1 billion USD and 34.4 billion USD respectively) have shown stagnation over recent years and are expected to continue like that. According to PwC's Global media outlook[18], the worldwide situation shows a similar trend. Online advertising totalled at 116.4 billion USD in 2013. TV advertising had a total revenue of 169.2 billion USD in the same year. The forecast until 2017 shows significantly higher growth rates for online advertising than for all other forms of advertising. PwC expect it to reach 185.4 billion USD in revenue by that time reaching almost 90 % of the revenue generated by TV advertising.

[16] Inc.: Music Streaming Wars: Top 8 Contenders, available at: http://www.inc.com/ss/jill-krasny/whos-who-music-streaming-wars#3

[17] IAB (2014): IAB Internet advertising revenue report.

[18] PwC: Internet advertising, available at: http://www.pwc.com/gx/en/global-entertainment-media-outlook/segment-insights/internet-advertising.jhtml

Figure 6: Global advertising market (USD million) 2011-2017



Source: PwC

In sum, services offered to the end user show a great breadth and are difficult to illustrate fully. Nonetheless, some key insights can be taken away from this first overarching analysis:

- The wealth of services offered to end users based on data and the variety of revenue models they rely on indicates a great number of potentially innovative business models.
- Current numbers of users and revenues as well as their projections indicate an overall highly positive outlook for services offered to end users based on data.

3.3 General characteristics of the data value circle

In the above, this paper has analysed the market sizes, developments and revenues for all fields of actors in the data value circle that structures the data-driven economy along the production, transport, handling and utilization of data. Three general characteristics can be drawn from this first analysis:

- Data are a significant economic factor, whose significance is likely to grow and drive structural change in all sectors.

The analysis in the above underlines the results from Section 2. Data have become a major resource for businesses worldwide triggering new business models and structural change for all sectors. The analysis in the above has clearly shown that the number of devices connected to the Internet will grow dramatically within the next years reaching far beyond PCs, laptops, mobile phones and tablets. This will further increase the amount of data available and to be transported on networks. It should be noted that unlike most other economic factors data become more valuable with increasing availability. The more data are available for analyses the more accurate the results can be. Also, the more data e.g. in form of video or music files a content provider has to offer the more valuable its service becomes. Also, more data will likely lead to more services offered to the end user. This development will also spur revenues in the fields of data handling and data networks. In sum, the data-driven economy appears to be at the brink of a virtuous circle. Thus, policy-makers need to consider what changes this might bring to industries that are strong contributors to the economy of their respective countries. They should investigate how exactly the structural change driven by data will affect them and devise effective strategies that can support businesses in adapting and profiting from this change.

- The data-driven economy is characterized by two-sided markets.

Already the structure developed in Section 3.1 indicates that actors in all fields of the data value circle are likely to have business relationships with actors situated before and behind them in the circle. The above analysis supports this assertion. For all four analysed fields two distinct customer segments can be identified:

- Device operating systems: (1) end user and (2) app developers
- Data networks: (1) end users and (2) actors from data handling and data based service
- Data handling: actors from (1) data networks and (2) data based services
- Data based services: (1) consumers (often serve for free) and (2) businesses paying for targeted advertising

Policy-makers should be aware of this fact and take it into account when devising policies that target specific fields within the data value circle. They have to keep in mind that the two-sided nature can be prone to dominant positions of specific market actors as it can be witnessed in operating systems for mobile devices. From the two-sided nature of many data based services, a strong incentive emerges to collect more and more data to make the actual value proposition of their business models i.e. targeted online advertising more competitive. This holds strong implications as regards privacy and consumer's ability to make (actual) informed choices about which data he or she is willing to give away in exchange for a free service. Both aspects will be further elaborated in Sections 4 and 5.

- It is unclear which players in the data-driven economy hold the most powerful position

As it transpired from the previous point, the data-driven economy has numerous points were market dominance can be achieved. Operating systems for devices, for instance, enable a significant influence on how end users interact with devices and which services may be offered on these devices. Also, it enables the providers of these operating systems to direct access to most data produced by the device itself. Data network providers have significant influence on connectivity, which is the essential precondition for any data-driven business, whilst providers of data handling may hold significant power about what can actually happen with data in terms of using them for services or analysis. Their performance is also critical for the end users' Quality of Experience (QoE). Finally, services appear to be the real driver of the data-driven economy making attractive offers to end users be it consumers or businesses on numerous levels.

The growing economic relevance combined with the yet unclear shape of market power and its two-sided market characteristic make shifts in relative market power likely and places great emphasis on how individual groups of actors in the data-driven economy are positioned today and likely to behave strategically in the near future. Consequently, a more detailed analysis of business models and potential strategic options is needed. The following section addresses this task. It contributes a detailed analysis of business models and accompanying strategic options for key value propositions within the data-driven economy highlighting emerging challenges for market actors, policy-makers and regulators.

4 Selected value propositions and business models in the data-driven economy

The selected value propositions present a representative picture of the data-driven economy as they have been selected from all market segments within the data value circle. For each segment, the value propositions that, based on the analysis in Section 3, appear most influential were chosen. Each of these value propositions is likely to have sustained strong impact within the expected structural change and to pose specific challenges for other actors in the market as well as for policy-makers and regulators:

- Mobile device ecosystems
- Connectivity
- Cloud services and content delivery networks (CDNs)
- Targeted online advertising

- Video streaming

The following sections will discuss and analyse these value propositions and surrounding business models in detail to derive potential strategic options for each group of actors in the data-driven economy and potential challenges for market actors as well as for policy-makers and regulators.

4.1 Mobile device ecosystems

Section 3.2.1 has shown that more and more devices connect to the Internet and gather and transmit data. Discussing all of them would certainly go beyond the scope of this paper. Thus, this section focuses on the value proposition of mobile device ecosystems common in mobile phones and tablets, which have been identified as one of the major components of the data-driven economy in Section 3.2.1. Interestingly, it was shown that despite a growing number of types of devices and stakeholders, this area of the data value circle still appears to be controlled only by very few actors via operating systems and accompanying mobile ecosystems. These companies have gained a potentially powerful position and thus merit a more detailed analysis of business models and strategic options. This section will therefore analyse their business models highlighting key differences and culminating in the identification of strategic options as well as potential challenges for both other actors in the market as well as policy-makers and regulators.

In the case of mobile devices in the sense of this paper, there is a de-facto duopoly of android-based mobile devices on the one hand and iOS-based mobile devices on the other hand. This is manifested, for example, in the shipment figures published by IDC for the third quarter of 2013[19] (see Figure 7), where the two firms hold 94 % of the market between them. Other competitors such as the Windows Phone or BlackBerry (Research in Motion) phones have only marginal influence in the market. Thus, the following analysis of business models and strategic options will focus on these two major competitors.

Interestingly, the business models of Google and Apple in the field of devices share some major characteristics:

- They both address a two-sided market consisting of two distinct customer segments: (1) consumers and businesses and (2) app developers relying on similar value propositions.

Consequently, their value propositions are also similar. For the customer segment of consumers and businesses, each competitor offers an operating system that enables a mobile ecosystem, to which the end user gains access through purchasing a device that is running the operating system. Both competitors offer their operating system free of charge to keep all users as up to date as possible and thus establish a common standard. This common and widespread standard environment is the value proposition offered to the second customer group i.e. app developers. The larger the number of users of any of these operating systems is, the more attractive it is for them to develop apps for this operating system. Taken together, this results in a so-called mobile ecosystem that offers almost infinite functionality and individuality of devices to end users and that, on the other hand, opens up a market for many developers. In Europe alone, it is estimated that around 800,000 jobs have been created in the so-called app-economy[20].

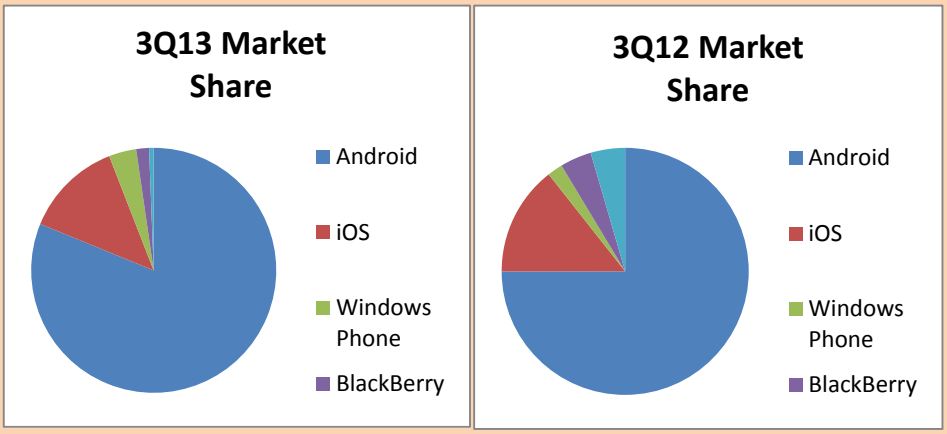
- For both, the major revenue stream stems from apps sold on their respective channels.

[19] IDC (2013): Android Pushes Past 80% Market Share While Windows Phone Shipments Leap 156.0% Year Over Year in the Third Quarter, According to IDC, available at: http://www.idc.com/getdoc.jsp?containerId=prUS24442013

[20] ACT (2013): The European app economy. Creating jobs and driving growth.

Figure 7: Worldwide mobile device shipments and market shares for the top-4 mobile operating systems in 3Q/13 in comparison to 3Q/12

Operating System	3Q13 Shipment Volumes	3Q13 Market Share	3Q12 Shipment Volumes	3Q12 Market Share	Year-Over-Year Change
Android	211,6	81%	139,9	74,90%	51,30%
iOS	33,8	12,90%	26,9	14,40%	26,60%
Windows Phone	9,5	3,60%	3,7	2%	156%
BlackBerry	4,5	1,70%	7,7	4,10%	-41,60%
Others	1,7	0,60%	8,4	4,50%	-80,10%
Total	**261,1**	**100,00%**	**186,7**	**100,00%**	**39,90%**



Source: IDC Worldwide Mobile Phone Tracker (2013)

Both Google and Apple gain revenue from each app sale on their channels (Google Play and Apple iTunes App Store). Apple reported more than 10 billion USD of revenue through their App Store in 2013[21]. Google Play registered roughly half that revenue according to App Annie[22]. With the growing number of devices as well as apps, this figure is likely to grow further.

- Both business models support lock-in effects.

A third aspect that the two competitors share is their ecosystems' proneness to lock-in effects that characterize the customer relationship of their business model. This is true for both customer segments addressed. Whilst end users are likely to be unwilling to lose their investments in apps that they usually cannot take with them when they opt out of one system, app developers often cannot afford to lose their established customer segments as their business model more often than not depends on continuous in-

[21] Apple (2014): App Store Sales Top $10 Billion in 2013, available at: http://www.apple.com/pr/library/2014/01/07App-Store-Sales-Top-10-Billion-in-2013.html?sr=hotnews.rss

[22] App Annie (2014): App Annie Index - Market Q1 2014: Revenue soars in the United States and China, available at: http://blog.appannie.com/app-annie-index-market-q1-2014/

app purchases or advertising rather than the initial fee for downloading the app. This appears to lend some long-term stability to the business models of the two main competitors in this area.

However, there is one important difference in their business models. Whilst Google provides the Android operating system and therefore access to its ecosystem of applications to anyone who wants to use it[23], Apple, on the other hand, complies with its long-established policy already known from its PCs and laptops of selling a bundle of a device together with a dedicated operating system. With the iPhone and the iPad, they follow their usual premium brand strategy. For Apple, this strategy pays off as they are one of the few firms which actually earn profits from their device-related revenue stream. Figure 8 documents Apple's profitability by Canaccord Genuity numbers[24] collected for major mobile device manufacturers from 2007 to Q3/13. These numbers show that Apple is the only manufacturer that can claim stable and substantial profits from 2007 to 2013 for its mobile devices business. It is noteworthy that the market has changed dramatically over the same period. Nokia had roughly the same operating margins in 2007 as Samsung had in 2013. Equally, BlackBerry had in 2008 about the same operating margins as Apple had in 2013. Both Nokia and BlackBerry are currently suffering.

The fast-changing nature of the market of mobile devices that these numbers imply may continue as the current market leaders do not go unchallenged. For instance, there are quite serious contenders for a potential third strong ecosystem. Microsoft's Windows Phone is certainly a valid candidate. Amazon is reportedly planning to launch its own mobile phone extending its already established ecosystem around the Kindle device[25]. Others have managed to bring key partners on board that may help them to a significant position in the market. For instance, Mozilla's Firefox OS initiative has found support by key international telecommunications providers such as America Movil, Telefonica, China Unicom, Sprint, Deutsche Telekom, and KDDI[26]. Also mobile device manufacturers like ZTE, Huawei, and LG act as key partners for Firefox OS. In a market environment with shrinking unit prices and where the highest growth can be expected from mobile device sales in developing countries[27], Firefox OS may be particularly well positioned as it provides a lean solution than can run on very simple phones or other devices.

Thus, it is not surprising that the two main competitors have devised strategies to extend their strong position in the field of devices. These strategies build on their key resources the existing customer base combined with the extensive knowledge these two firms have about consumer behaviour and their key activity in this area i.e. building mobile ecosystems that enable a seamless customer experience and offer added value to app developers. The main strategic direction appears to be entering additional types of devices. Google offers Google Glass currently only in a trial phase, but normal sales are expected to commence this year. This device is strategically interesting for Google as it will enable them to expand their revenues from selling devices themselves, but more importantly this device is likely to be physically

[23] It should be noted that some fees usually apply to get a third-party certificate that allows a device manufacturer to run Google Mobile Services (GMS). See http://www.theguardian.com/technology/2014/jan/23/how-google-controls-androids-open-source

[24] Shared by Canaccord Genuity analyst T. Michael Walkley with the industry blog AppleInsider on the occasion of a research note; see http://appleinsider.com/articles/13/11/14/apple-samsung-take-massive-109-of-mobile-industry-profits-while-competitors-lose-money

[25] TechRadar (2014): Amazon phone release date, news and rumors, available at: http://www.techradar.com/news/phone-and-communications/mobile-phones/amazon-phone-release-date-news-and-rumors-1085821

[26] Mozilla (2014): Unleash the future, available at: http://www.mozilla.org/en-US/firefox/partners/

[27] The Guardian (2014): Smartphone explosion in 2014 will see ownership in India pass US, China and India will add more than 400m new smartphone users amid growth for FirefoxOS and Android, forecasts Mediacells, available at: http://www.theguardian.com/technology/2014/jan/13/smartphone-explosion-2014-india-us-china-firefoxos-android

even closer more often to its user than the mobile phone and thus will give Google access to more valuable data that can be used for their main value proposition targeted online advertising (see Section 4.4). The second area, which appears to serve the same purpose for Google is Google Nest, a home-automation system that Google plans to launch. Apple's plans appear to be somewhat vague; nonetheless, it seems obvious that also they will attempt to capture additional device in their mobile ecosystem. The acquisition of Beats can be considered an example. Both competitors have entered associations that seek to bring their ecosystems into cars.

Figure 8: Operating profitability for mobile device manufacturers from 2007 to Q3/13

	2007	2008	2009	2010	2011	2012	Q113	Q213	Q313
Apple operating income	600	2421	5249	10482	26723	35903	8034	5991	6,487
Apple mobile device operating margin	28%	28%	33%	35%	44%	41%	35%	33%	33%
Apple value share	4%	14%	35%	44%	65%	69%	58%	53%	56%
Nokia operating income	117	9586	4905	4418	2347	-905	5	-42	-63
Nokia mobile device operating margin	20%	18%	13%	11%	7%	-4%	0%	-1%	-2%
Nokia value share	67%	57%	33%	19%	6%	-2%	0%	0%	-1%
Samsung operating income	1561	1754	2246	3465	7078	17458	6019	5632	6,125
Samsung mobile device operating mar	10%	9%	9%	10%	15%	21%	22%	19%	20%
Samsung value share	10%	10%	15%	15%	17%	34%	43%	49%	53%
BlackBerry operating income	809	2554	3219	4408	2996	-230	17	-143	-426
BlackBerry mobile device operating ma	21%	33%	27%	30%	20%	-3%	1%	-7%	-55%
BlackBerry value share	5%	15%	21%	19%	7%	0%	0%	-1%	-4%
Motorola operating income (loss)	-688	-1458	-925	-198	-126	-604	-236	-218	-292
Motorola mobile device operating mar	-4%	-12%	-13%	-3%	-1%	-8%	-23%	-22%	-26%
Motorola value share	-5%	-9%	-6%	-1%	0%	-1%	-2%	-2%	-3%
Sony (Sony Ericsson) operating incom	2110	32	-1430	214	-287	-602	-23	72	0
Sony mobile device operating margin	12%	0%	-15%	3%	-4%	-8%	-1%	3%	0%
Sony value share	14%	0%	-10%	1%	-1%	-1%	0%	1%	0%
LG operating income (loss)	658	1188	1017	-575	-254	48	123	55	-73
LG mobile device operating margin	8%	11%	7%	-5%	-2%	1%	4%	2%	-3%
LG value share	4%	7%	7%	-2%	-1%	0%	1%	0%	-1%
HTC operating income	0	908	725	1452	2329	640	1	35	-118
HTC mobile device operating margin		20%	16%	17%	15%	6%	0%	1%	-7%
HTC value share	0%	5%	5%	6%	6%	1%	0%	0%	-1%

Source: Canaccord Genuity (2013)

The current position and the strategic avenue of the two major competitors in the field of devices as part of the data-driven economy holds some challenges for actors in the market as well as policy-makers and regulators. Actors in the market within and without the data-driven economy may see themselves faced with increasing entry-barriers due to the strong customer relationships that the existing competitors have established. With the increasing number of types of devices the two major competitors in this field can draw into their systems these barriers grow further. Also, every new app has to be certified for the respective platform and can be removed from these platforms by its owner, giving the two major competitors in this field a powerful position. For all competitors in the field of devices, connectivity to the Internet will be a key bottleneck to extending their markets. This is particularly true in developing countries, where some competitors (e.g. Google, Microsoft, and Apple) have started experimenting with their own access solutions. Given the growing number of devices and the growth of mobile traffic, spectrum may become a limiting factor to the types of services that can be transmitted to mobile devices. These last two challenges are certainly also relevant to policy-makers and regulators. Moreover, issues of privacy protection may become an even more pressing issue as more and more devices run within the same ecosystems and potentially allow combining data across numerous devices and situations. Such combinations may, for instance, enable the transformation of anonymous data into personalized data.

4.2 Connectivity

The value proposition of connectivity is really at the heart of the data-driven economy. Without it, no one would be able to access electronic communications based service and no data could be transported or distributed within the data value circle. Subsumed under this value proposition in this section are access to electronic communication and transport of data and connectivity amongst data networks. It is important to note that within this value proposition, one of the unique characteristics of the data-driven economy is that two communication partners are very likely to obtain access from different network operators. Network operators, thus, need agreements and common standards for interconnection and the hand-over of traffic which either originates from a source, or which is intended to be transported to a destination outside their own network.

In essence, the connectivity value proposition relates to two rather different customer segments:

- The access business represents the customer-provider relationship involving a network operator and either an end user or a service/content provider.
- The inter-carrier business typically represents either a customer-provider relationship among two network operators of different traffic volumes and geographical reach (called transit), or else a typically free-of-charge agreement among network operators of comparable traffic volumes (called peering).

The value propositions in those two business segments shape the business model of a network operator both on the revenue and on the cost side. For the latter, it is essential to comprehend the effect of growing traffic volumes:

- Traffic growth implies the risk for a network operator to be forced to implement its value proposition at higher costs, without being able to scale revenues accordingly.

There are a number of factors that influence this risk. Especially in the access business, network infrastructure may become a bottleneck resource meaning that access networks run at their capacity in peak hours. Network planning has always been driven by peak (not by average) traffic volumes as there are huge traffic volume fluctuations over the course of a day. Different approaches exist to give incentive to end users to shift their usage to off-peak hours, but with the rise of flat rate-based charging in both the fixed and mobile access business, many of these incentives are essentially obsolete. Network operators are in consequence exposed to a pressure to continuously and drastically increase network capacity – which means significant capital expenses.

In this light, considerations on data ARPU as outlined in Section 3.2.2 need to be reflected. Data ARPU would have to raise quite substantially, as it would have to compensate not just one trend (increasing data traffic), but also decreasing voice ARPU (the traditional voice-oriented telecommunications business) as well as a potential increase in costly IP transit traffic. IP transit traffic is likely to increase as more end users have access, as more devices become connected, and as additional types of devices become connected (and create additional – novel – traffic). This is due to the fact that in the data-driven economy traffic is often transported across multiple networks as described in the inter-carrier business above. In case of a communications path involving transit, the smaller network operator typically needs to pay the larger one.

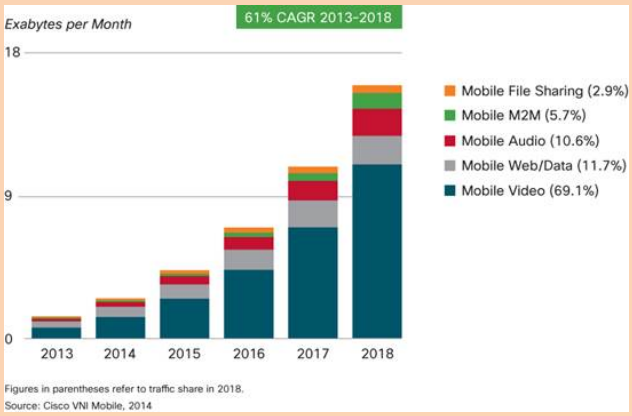
It needs to be emphasized that the above factors contribute to a risk only. The examples given in Section 3.2.2 for AT&T and Bharti Airtel show that it is possible to keep overall ARPU levels relatively stable – in other words, decreasing ARPU is not a given for all network operators. Higher traffic volumes do not automatically lead to higher traffic acquisition costs as unit costs are decreasing. Moreover, even in times of flat rates, there may be other instruments that give incentive to (heavy) users to limit their data usage (e.g. data caps).

Since data exchange is bi-directional, the increase of data volumes from one side of electronic communications implies a multiplication of data by the respective other side responding. This multiplication may take extreme forms when considering products and services in the data-driven economy that are characterized by asymmetric bandwidths needed for request and response. For

instance, when an end user requests a video stream, the request in itself means relatively little data to be transported and routed in and across interconnected networks. The response, however, is an ongoing flow of data of much larger size.

To stay with this example, the network operator that connects the respective video streaming provider to its data network will most probably be able to monetize the traffic pushed into its network. Both sides of the access business normally pay for connectivity – end users as well as service/content providers. A problem may arise though for the network operator that has to transport the substantially larger response to the requesting party (its customer) without being able to earn from the relevant source generating most of the traffic (not its customer). This situation is further intensified when considering that it is exactly those services with asymmetric bandwidth requirements that are about to cause the most traffic in data networks in the future. Cisco's forecast illustrates the expected growing importance of video in mobile traffic (see Figure 9).

Figure 9: The importance of video and audio in mobile data forecasted for the period from 2013 to 2018



Source: Cisco Visual Networking Index (2014)

All these factors combined explain the fundamental change that the industry is undergoing. This leads to a second part of discussion in this section, namely the analysis of strategic options that may lay down paths towards viable and sustainable business in the future. The set of strategic options may be subdivided into four areas:

- To further optimize the cost of data traffic.
- To obtain access to revenues (or at least a relevant share of it) from those who create masses of traffic.
- To offer entertainment-oriented value propositions in addition to connectivity.
- To start monetizing end user data.

The optimization of costs related to data traffic may mean a set of different measures. In relation to the access business, the fostering of offloading traffic to e.g. unlicensed spectrum and infrastructure such as WiFi hotspots may certainly constitute an option which will be available already in the nearer future. For the inter-carrier business, a near-term response towards lower costs may be negotiating and concluding more peering agreements. On a more long term perspective, larger network operators may intensify their regional or international presence with an extended backbone network. As prices for IP transit fell quite drastically in recent years, however, some network operators may decide differently and invest less in (or even crowd out from) this business segment in anticipation of being able to source transit traffic at anyway falling prices from third parties. On an even longer time horizon, exploring efficiency gains (and the resulting cost optimizations) by ongoing research activities may become highly relevant. Examples include the utilization of end-user infrastructure in the access business and different ways to route traffic in networks. The latter relates primarily to routing mechanisms that qualify best for content (thus, traffic-

intense) delivery. Information-centric networking approaches may be investigated in this context. Also, the use of multicast-based techniques in existing networks may constitute an interesting future opportunity to reduce transported traffic in large parts of a network.

The option for sourcing from third parties may become a valid option to optimize costs even further. The so-called Minute Factory business model (introduced by Bharti Airtel in the early 2000s and successfully applied ever since) could be a template for such cost-optimized business structure in the data-driven economy. It aims to minimize the production costs of a voice minute or a data packet. All activities which are not considered a key activity are outsourced to partner businesses. Outsourced – thus, non-key – activities include IT, network management, and call centre management. The underlying assumption is that the respective outsourcing partners are able to provide the activity in question more efficiently, resulting in lower total expenses for the outsourcing network operator, which in turn can optimize its (smaller set of) key activities and key resources. The remaining key activities are then to monitor resource usage very closely, to design and manage products and the respective pricing according to observed and anticipated service usage patterns, and to gradually extend the infrastructure of the network where usage goes beyond a certain threshold value.

Obtaining access to revenues from those who create masses of traffic has been identified as the second major strategic option. This may mean for a network operator to build CDN and data centre infrastructure in order to offer the respective cloud infrastructure and services to content and service providers. As data centres are by their very nature sources or destinations of larger traffic volumes, providing access, transport and connectivity to/from a data centre would enable a network operator to participate in the respective revenue streams. Especially when being able to optimize the storage of data in data centres and, at the same time, its delivery in a CDN, network operators would be in a unique position to combine the connectivity value proposition by means of the cloud and content delivery value propositions. However, this strategy appears to be difficult to achieve for network operators as the market for CDNs and cloud services can already be considered a relatively mature market (see next section) that has entered the phase of strong price competition.

On a similar line of thoughts, a network operator may go into all sorts of different partnership agreements with content/service providers. This could be an arrangement among a player like Spotify and a mobile network operator in which the technical part of the agreement would mean that Spotify's servers are replicated within the operator's network. Spotify traffic would ideally be limited to in-network traffic (except for the transit/peering traffic for regularly updating replica servers). In return, the network operator could offer a rebated monthly Spotify subscription. Not to forget that Spotify could promise its users a better quality of experience due to expectedly low response times as well as the fact that traffic stays within the operational domain of a single operator. In addition, Spotify could profit from much lower traffic acquisition costs – leading to a win-win situation for both the (network and service) provider as well as the user side.

Similar scenarios may cover agreements that include traffic prioritization for which the service/content provider would be willing to pay in order to ensure that its customers benefit from a satisfactory experience. The example of Netflix shows that there may be room for such agreements even though service/content providers will certainly try to avoid cost-sharing approaches and/or traffic prioritization payments. In light of strong net neutrality movements, it is, however, questionable whether such cost-sharing solutions are really viable in the long-term and will be accepted by all market players. Furthermore, traffic prioritization payments may become a regulatory concern in some markets.

The third major strategy option identified in the above means for a network operator to extend its traditionally connectivity-focused value proposition by offering entertainment-oriented value propositions in addition. This relates for instance to offer bundles combining the connectivity product (and possibly a telephony product) with IPTV, video-on-demand, music streaming, and similar managed products. In addition to developing additional fields for revenue, such bundle products may have the advantage to facilitate a high level of customer loyalty, and this would give the operator access to new insights on user behaviour which it may be able to monetize.

Monetizing end user data is the fourth major strategic option available to network operators. This is not a field where operators have been active traditionally. The reasons may be regulatory or simply less pressure to work based on these data as network operators had a viable and sustainable revenue model at hand. Nonetheless, there are first moves by larger network operators in recent years which show that the economic value of end user data did not stay unnoticed in this transforming industry. Examples for companies with activities in this field are AT&T, Verizon, and Telefónica. The latter has founded a business unit that aims to market footfall[28] data to local businesses. This example represents still a rather unsuspicious case for monetizing user data – first of all, footfall data is aggregated data (not data on an individual level) and second it just touches a very limited set of knowledge that a network operator potentially has access to about an end user. Naturally, such a strategic move of operators in the field of services within the data value circle has to be accompanied by a debate and the establishment of clear guidelines needed with respect to what is acceptable use of end user data for a network operator.

However, extending one's field of operation within the data value circle is an opportunity that also OTTs are keen to pursue. They may extend their already existing or announced activities towards becoming network operators of their own. The Google Fiber initiative is a very prominent example for such development. Albeit being limited to a number of geographically bounded US markets, Google's activities appear to prompt response by established network operators. AT&T has very recently announced[29] to deploy gigabit fibre in 100 US cities – which is supposedly a direct reaction to Google announcing[30] two months earlier to expand its fibre activities to 34 additional cities. Google Fiber is just one example of OTTs considering becoming network operators. Facebook's Connectivity Lab is an example for a research activity that investigates drones, satellites, and laser technology to provide Internet access especially in developing countries. Other activities may – in the long-term – threaten the exclusive reach of operators to end users: Technology is becoming available, or is under development, that has the potential to break up the termination monopoly in mobile communications. This includes a wide range of different approaches ranging from "downloading" a SIM card on the fly (e.g. Cell-Buddy[31]) to auction-based mobile termination (e.g. AbaCUS[32]).

4.3 Cloud services and content delivery networks

Just as connectivity in the preceding section, the value propositions of cloud services and content delivery networks (CDNs) as part of the data handling in the data value circle represent key enabling infrastructures/services for a functioning data-driven economy. Both data networks and providers of data-based services depend on data handling. In Section 3.2.3, this paper has already illustrated the market size and projected increases for cloud computing infrastructure services including CDNs. This section sets out to analyse the business models of the leading providers of cloud infrastructure and

[28] Footfall relates to the number of people stepping into a geographic area, such as a street segment. Businesses with stores in that area may profit from footfall data. Footfall gives insight into when and how many people pass by in front of a store location, whether people stop at, e.g., a café nearby etc. By combining footfall data with other user profile attributes, a network operator can offer enriched information (beyond pure footfall data) that, for instance, allows a business to assess whether people passing by might fall into a targeted market segment.

[29] http://about.att.com/story/att_eyes_100_u_s_cities_and_municipalities_for_its_ultra_fast_fiber_network.html

[30] http://googleblog.blogspot.de/2014/02/exploring-new-cities-for-google-fiber.html

[31] http://web.cell-buddy.com/

[32] http://www.csg.uzh.ch/research/abacus.html

software services to arrive at strategic options and derive potential challenges for market players as well as policy-makers and regulators.

According to Synergy Research[33], Amazon is currently the company that holds the largest share of the cloud infrastructure services market. They hold 5.2 % of the market. With Verizon, who hold 3 % of this market interestingly one of the main contenders is a network operator. This illustrates that this is the point within the data value circle where most providers of data based services and operators of data networks may become successful due to their existing data management infrastructure and capabilities to handle data.

In fact, Amazon's business model as regards data handling for third parties is a perfect example of how infrastructure and know-how originally aimed at providing a specific service function were turned into a business model of their own. To run their extensive e-commerce service, Amazon had to install substantial IT-infrastructure early on and learn how to effectively handle and analyse large data volumes. Amazon turned these resources into a business model of its own with the launch of Amazon Web Services in 2002. The fact that this service could be offered at a per-use basis made it attractive for both Amazon and their customers[34]. Over time, Amazon has added various services all revolving around their ever growing IT-infrastructure[35]. Amazon Web Services experienced another boost as apps and all kinds of other OTT services required affordable and scalable services supporting their own offerings in the background[36]. Such services include elastic cloud storage, content delivery networks as well as authentication. The most important of those services are Amazon Elastic Compute Cloud and Amazon S3 (Simple Storage Service)[37]. Most notably, Amazon handles most Netflix data (see Section 4.2.5).

In principle, Verizon have followed a similar strategy to enter the area of data handling. As a provider for fixed-line and mobile internet access Verizon owns an extensive telecommunications network. The provided bandwidth and its competence in network management can be regarded as key enablers for the cloud based services[38]. As some Verizon subsidiaries such as Wireless have reached market saturation[39] the requirement to identify new streams of revenue and new groups of customers became evident. Having acquired Terremark (a company specialized on datacentre management), Verizon became a main contender with Verizon Cloud Compute and Verizon Cloud storage services[40]. Verizon also initiated partnerships with computer software companies like Oracle in order to enhance the flexibility and the

[33] Synergy Research Group (2013): Cloud Infrastructure Services: Market Primer.

[34] Isckia T., Lescop D (2009): Open Innovation within Business Ecosystems: A Tale from Amazon.com, Communications & Strategies, vol. 74(2), available at: http://repec.idate.fr/RePEc/idt/journl/CS7402/CS74_ISCKIA_LESCOP.pdf

[35] Amazon (2013): History & Timeline, available at: http://phx.corporate-ir.net/phoenix.zhtml?c=176060&p=irol-corporateTimeline

[36] The Register (2012): Amazon to all data centers: Keep up, if you can, available at: http://www.theregister.co.uk/2012/04/19/amazon_vogels_aws_summit/

[37] ZDNet (2012): How Amazon exposed its guts: The History of AWS's EC2, available at: http://www.zdnet.com/how-amazon-exposed-its-guts-the-history-of-awss-ec2-3040155310/

[38] Lens 360 (2013): Verizon's Cloudy Services Horizon, available at: http://blog.saugatucktechnology.com/verizon-cloud-services-horizon/

[39] Verizon: Industry Overview, available at: http://www.verizon.com/investor/industryoverview.htm

[40] Datamation (2013):Verizon Unveils New Cloud Strategy , available at: http://www.datamation.com/cloud-computing/verizon-unveils-new-cloud-strategy.html

options for customers deploying Oracle software in the cloud[41]. Recently, Verizon offered supplementary services to address security and operational issues, e.g. the Secure Cloud Interconnect service for business customers.

Akamai's core market has been CDNs. The company estimates that 15-30 % of the worldwide data traffic is transmitted via their network[42]. Notable customers are e.g. Facebook, Netflix, Apple, Yahoo!, Bing and Twitter. In contrast to Amazon and Verizon that started their business in other segments of the telecommunication market, Akamai focused on data handling since the beginning of its operation. Due to increasing demand and traffic volume in video streams, social media, shopping, online games and software downloads, Akamai reported increased revenues and operating margins in the last quarters (as documented in Akamai's quarterly reports). Shopping Content and Media Content Delivery are considered the most valuable segments of its operation[43]. Akamai's pricing strategy appears to remain competitive, also in times of challenges by former customers[44]. In order to respond to security concerns and extend their business, Akamai offers the solution like the Kone Site Defender for their customers. Moreover, Akamai include more value added services to their portfolio like other cloud applications and the delivery of targeted advertising[45]. The company also prepares to resume operations for mobile traffic.

These three examples of business models around the value proposition of cloud infrastructure services illustrate that this part of the data value circle has become very competitive as actors from both surrounding segments i.e. data based services and data networks have entered the business. With Google, a fourth very serious contender for the future lead in this market has already entered the scene. Similar to Amazon, they also have accumulated a significant IT-infrastructure and knowledge of data handling including their own CDN. Despite these significant resources, they feature not yet amongst the Top 3 players in the IaaS/PaaS market (based on revenues according to Synergy Research numbers[46]). However, due to their aggressive pricing strategy, this is likely to change soon. In 2014 alone, they cut the price for the IaaS service Google Compute Engine by 32 % across all regions and sizes[47]. Moreover, the price for the storage services Google Cloud Storage was even decreased by 68 %.

CDNs represent a specific value proposition within the field of cloud infrastructure services. They are an overlay to the existing internet infrastructure. By means of globally distributed and strategically located

[41] Ovum (2014): Verizon partners with Oracle to offer database services by the hour, available at: http://ovum.com/2014/01/25/verizon-partners-with-oracle-to-offer-database-services-by-the-hour/

[42] Akamai (2014): Visualizing Global Internet Performance with Akamai, available at: http://www.akamai.com/html/technology/visualizing_akamai.html

[43] Wall Street Journal (2014): Akamai Profit Rises 1.8%, available at: http://online.wsj.com/article/BT-CO-20140501-716049.html#

[44] Wall Street Journal (2014): Akamai Hints It Can Weather Competition From Customers, available at: http://blogs.wsj.com/digits/2014/02/05/akamai-hints-it-can-weather-apples-diy-effort/

[45] Forbes (2013): Akamai Earnings: Watching For The iOS7 Impact With An Eye On Margins, available at: http://www.forbes.com/sites/greatspeculations/2013/10/21/akamai-earnings-watching-for-the-ios7-impact-with-an-eye-on-margins/

[46] Synergy Research (2014): Amazon Continues to Dominate IaaS/PaaS Despite Strong Push from Microsoft & IBM, available at: https://www.srgresearch.com/articles/amazon-continues-to-dominate-iaaspaas-despite-strong-push-from-microsoft-ibm

[47] Google (2014): Google Cloud Platform Live - Blending IaaS and PaaS, Moore's Law for the cloud, available at: http://googlecloudplatform.blogspot.de/2014/03/google-cloud-platform-live-blending-iaas-and-paas-moores-law-for-the-cloud.html

servers, CDNs aim to optimize the transmission of content via the internet. Starting over a decade ago, a wide variety of models regarding the configuration of the architecture can be differentiated. The primary customers of CDN providers are content providers that transmit the large data volumes that are often needed for data-based services.

In a dynamic market environment with an increasing amount of data traffic, the market players have chosen very different business models and strategies. However, several stereotypical business models can be distinguished: CDN specialists like Akamai, Edgecast and Limelight concentrate their entrepreneurial activities solely on the provision of CDN services and have shaped the CDN market since its beginning. Akamai represents the dominant company in this segment of the CDN market. Players entering the market to a later point of time have not focused their business models solely on CDN services. Instead, the CDN services were added to their product portfolio. Those providers can be divided into two groups: integrated CDN Providers owning an internet access infrastructure on the one hand and CDN resellers on the other hand[48]. Similar to cloud services in the above, the market for CDN is very competitive. It may also happen that providers of data based services with an own CDN decide to open this resource to third parties just like Amazon did with their IT-infrastructure. Such a move would certainly further increase competition in this field. This very competitive market poses serious challenges to market players. They will either have to significantly reduce costs to remain competitive or find other revenue streams like Akamai have done.

Since, due to energy costs, data centres are often situated in areas where there is naturally cold weather and services based on data usually address an international or global market, companies have to manage data handling across borders, which could become more difficult in light of the concerns that have emerged from the NSA debate triggered by the whistle-blower Snowden. Policy-makers should address this issue with great care in order not to impede specific actors. However, they have to strike a balance as regards valid security concerns of the businesses in their country that want to store data reliably and safely.

Finally, as cloud infrastructure services also address more and more consumers directly or indirectly through data based services, a debate has to be started as regards what consumers do understand about this issue, how important contractual parts can be presented to them in a manner that they are likely to comprehend and if these steps would help them to make informed decisions. Furthermore, as data are circulated around the globe and consumers as well as businesses cannot always be sure which jurisdiction currently applies, clear guidelines ought to be drawn up in order to support comprehension of this issue for end users of services as well as to clarify the legal frameworks for providers of services.

4.4 Targeted online advertising

As it has been shown in Section 3.2.4 many services offered to consumers free of charge rely for their revenues on the second customer segment of businesses, which seek access to these consumers through targeted online advertising. Consequently, these services can be considered to serve a two-sided market with targeted online advertising being the most important value proposition as regards the revenue stream within the business model. This basic structure of this business model is quite similar across the numerous services that apply it. Prominent examples include Google, Facebook, Bing (Microsoft's search engine), Yahoo and Twitter. Many smaller and less prominent actors in the area of services apply this business model, too.

[48] Gries / Philbeck (2013): Marktentwicklungen im Bereich Content Delivery Networks.

The key competitive advantage that online advertising holds over other media outlets is based on data collected about the consumer who is intended the target of the advertising. These data enable a much more individualised approach that results in a significantly higher Return on Investment for businesses buying advertising[49]. Thus, it is not surprising that the large competitors in this field have strategically constructed their business models around generating data about consumers. Google is probably the most all-embracing example offering free services for search, navigation, mailing, calendar, office applications, image viewing and editing, social networking and so forth. Recently, they have also entered the field of devices selling their own mobile phones, tablets, laptops, glass and home automation amongst other things. Thus, Google can gather more user data than any other company.

Facebook seems similarly well-equipped, although they follow a different strategy. Their business model is constructed closely around their major public value proposition i.e. their social network service. This site alone gives them access to extensive data about approximately 1.2 billion active users. A significant part of Facebook's success may be attributed to their smart strategy as regards the involvement of third parties and lowering the barrier to enter the network. Involvement of third parties was achieved early on through the launch of the Facebook Platform in 2007. This service enables third parties to access Facebook's "Social graph" and place advertisements, but also to connect their content to Facebook via a so called "like button". By this, Facebook is also able to collect some (rudimentary) data about their users' behaviour outside the network. Beacon, a technology introduced not much later had the objective to learn even more about users' behaviour outside of Facebook. This technology was, however, discontinued due to legal reasons and widespread public concerns. Instead, Facebook offers instant personalization for selected external sites since 2010, which allows Facebook users on third party sites to receive individualized content e.g. only reviews of a particular movie written by their Facebook friends. Besides tracking users outside of their site, Facebook have also found ways to lower the technological barrier for those who are still outside of the network due to insufficient connectivity in particular in developing countries. In 2010, they launched Facebook Zero, which is a text-only version also accessible on simpler phones. To make themselves more attractive to consumers, some carriers have decided to offer this service even at no charge. Facebook for SIM followed in 2011. It provides access to the network even without a data contract.

In sum, it is not surprising that these two companies control the digital advertising market. Google holds around one third of the total digital advertising worldwide. Facebook follows in second place with a market share of 5 %. For mobile ads, Google even controls almost 56 % of the market, whilst Facebook holds close to 13 %[50] (see Figure 10). Thus, it also not surprising that both companies are able to earn substantial profits from their respective advertising businesses.

Pandora on the other hand, even though it is a significant player in the mobile advertising market, cannot make a profit. One reason for this is likely a significantly smaller user group resulting in less data. The data themselves are also less valuable e.g. the likes as regards music only as compared to a holistic view on consumer behaviour. Furthermore, Pandora is less profitable due to their cost structure. Google and Facebook, for instance, do not have to pay royalties for their services. For the music streaming service, instead, royalties and legal costs pose a serious threat to a profitable business in the long run.

[49] Arnold and Schiffer (2011) found that the ROI for Google AdWords is on average almost 12 times the ROI to expected from other advertising format (Arnold, R. & Schiffer, M. (2011): Faktor Google – Wie deutsche Unternehmen Google einsetzen. IW Consult: Köln.)

[50] eMarketer (2013): Google Takes Home Half of Worldwide Mobile Internet Ad Revenues. - available at: http://www.emarketer.com/Article/Google-Takes-Home-Half-of-Worldwide-Mobile-Internet-Ad-Revenues/1009966#sthash.MjU6yas0.dpuf

The fundamental success factor for this business model is the number of users and the value of data that can be collected, analysed and used to target them. This implies that services that seek funding by offering targeted online advertising are likely to need an international distribution. Technically, this is easily achieved, however, legal and regulatory barriers are likely to hamper some services. This underlines the need for a more international approach to legislation and regulation that has transpired at various places in the above. This will be pivotal to future innovative services funded by advertising.

Foreseeable strategic options of actors base on these circumstances and depend on the market position of the specific actor. The main competitors in the market are likely to try and manifest and extend their market position. One avenue to achieve this is to gain access to data that originally was unattainable. Google has made steps into this direction offering more and more devices that can collect and transmit data, extending its business to data networks even up to the individual household (Google Fiber) and to data handling e.g. cloud services. Facebook, on the other hand, seems to follow a different strategy, targeting developing countries strongly with simplified versions of their service that will also run on simple phones as well as experimenting with their own connectivity solutions. As it transpired from the market shares in online advertising detailed earlier in this section, smaller actors in the market tend to have problems gaining a critical mass of users and monetising their services. Therefore, their strategic option lies more with either attracting a very valuable user group or very valuable data. To achieve this, they have to be innovative.

Figure 10: Market Shares online advertising and mobile advertising worldwide

	Online Advertising worldwide			Mobile Advertising worldwide		
	2011	2012	2013	2011	2012	2013
Google	32.08 %	31.46 %	33.24 %	38.11 %	52.36 %	55.97 %
Facebook	3.65 %	4.11 %	5.04 %	-	5.35 %	12.90 %
Yahoo!	3.95 %	3.37 %	3.10 %	-	-	-
Microsoft	1.27 %	1.63 %	1.78 %	-	-	-
IAC	1.15 %	1.39 %	1.47 %	-	-	-
AOL	1.17 %	1.02 %	0.95 %	-	-	-
Amazon	0.48 %	0.59 %	0.71 %	-	-	-
Pandora	0.28 %	0.36 %	0.50 %	2.99 %	2.71 %	2.50 %
Twitter	0.16 %	0.28 %	0.50 %	-	1.57 %	1.95 %
LinkedIn	0.18 %	0.25 %	0.32 %	-	-	-
Millenial Media	0.05 %	0.07 %	0.10 %	1.00 %	0.82 %	0.76 %
YP	-	-	-	2.32 %	2.86 %	2.39 %
Other	55.59 %	55.48 %	52.28 %	55.58 %	34.33 %	23.53 %
Market size (billIon US$)	86.43	104.04	116.82	04. Feb	Aug 80	15.82

Source: eMarketer (2013)

Next to existing actors the profitability of this business model is likely to attract new stakeholders. Providers of electronic communications, for instance, potentially have access to a wealth of data about their customers. Equally, it appears sensible to transfer the principles of this business model to other industries that handle potentially valuable data such as health, car manufacturers, manufacturers of navigation systems and so forth. Most likely the value proposition here would not be advertising, but rather consulting and market insights. This development might steer towards data becoming a key resource for business models across numerous sectors giving data more and more value. Eventually, this may create a market for data, where individual companies may acquire data that they themselves may not be able to collect, but which are relevant for the service they offer to other companies. Policy-makers should consider this possibility seriously and discuss if and how they want to react to it.

Such a development would emphasise the need for consumer education that is apparent already today. Consumers should be enabled to make informed actual decisions about which data are collected about them and what may happen with these data. Consumers should be made aware of the fact that their behaviour is not simply traced, but analysed and inferences are made and used by others to make a profit. Today consumers have little opportunity to learn about this nor do they have a real choice when it comes to using devices like mobile phones, tablets or even cars with connected features. Next to enabling consumers in that way e.g. through a standardised and intuitive terminology for contracts agreements, policy-makers also have to keep in mind general issues revolving around privacy. As more and more data are collected and potentially combined, anonymous data can with relatively little effort be honed down to either a small group of individuals or even the individual person him- or herself. This is even more important as such data may result in discrimination if, for instance, such data are used to decide who is the right candidate for a specific job opening.

Finally, it may be relevant to consider if one is willing to trade the more and more important objective of connecting everyone especially in developing countries for increased control of few competitors in the market, who may block innovation when they become a gatekeeper of the access as well as important services and their monetisation through online advertising.

4.5 Video streaming

Video streaming is one of the services offered to end users within the data value circle. It comprises IPTV as well as video on demand (VoD) services including offers by telecommunication companies (e.g. Deutsche Telekom), cable companies (e.g. Verizon) and OTTs (e.g. Netflix, Hulu, YouTube, Vevo).

This value proposition is interesting to analyse here as this service is clearly the most important source of data traffic on the Internet and therefore future developments in this area are likely to have significant impact on the business of other stakeholders in the data value circle i.e. data networks and data handling, but also policy-makers and regulators. From a business perspective, it is interesting to note that there has not yet emerged a dominant player in this market. Accordingly, there is a wide variety of business models especially as regards how revenue streams are generated. Although many of these services are not profitable so far, they have specific competitive advantages as compared to broadcast and cable TV and may alter the media landscape significantly. Consequently, the following paragraphs first discuss and analyse the variety of revenue models and corresponding profitability of business models as well as other critical success factors. Hence, this section sheds light on specific advantages of video streaming services and how they may further impact the media landscape. Finally, strategic options of actors in the market and potential challenges for them as well as policy-makers and regulators are highlighted.

Video streaming is supported by a wide variety of revenue stream concepts. Revenue concepts stretch from fully advertising-based ones (e.g. YouTube, Vevo) to subscription only services (e.g. Netflix). The following paragraphs illustrate two examples of video streaming services that earn a profit and exemplify the two ends of revenue models: YouTube and Netflix. IPTV services offered by telecommunication providers are also discussed below.

YouTube profits from Google's proficiency and market share in targeted online advertising (see Section 4.4) and can operate at a significant profit selling targeted online advertising. Other major success factors within YouTube's business model are the key ability to deliver a high quality of experience for the consumer based on Google's own network infrastructure and the wide variety of largely user generated content. YouTube shares its advertising revenues with users who have uploaded content and allowed the advertisement placements.

Netflix, on the other hand, does not show any advertising. Its revenue model is completely subscription-based. Since they could not rely on an already established infrastructure like YouTube, the major success factor for their business model has been key partnerships. On the one hand, this refers to device manufacturers and their respective ecosystems. Netflix established partnerships with video game console manufacturers (Microsoft in 2008; Sony in 2009; Nintendo in 2010), television manufacturers (Samsung, LG and Sony in 2009; Panasonic and Google TV in 2010) and manufacturers of mobile devices (Apple in

2010; Microsoft in 2010; Android (Google) in 2011; Nook in 2011) to facilitate seamless access for the end user or even have the Netflix preinstalled as it happened with Nook tablets. On the other hand, Netflix had to establish key partnerships with content producers. Most notably they recently formed a partnership with DreamWorks that will enable them to bring first rate Hollywood content to the Internet first. Just like for YouTube QoE plays a pivotal for Netflix' success. Thus, they also have established partnerships with firms that offer data handling (Amazon) and Comcast as well as Verizon to give priority to Netflix's traffic on their networks. Beyond that, they produce high-quality original content only accessible through their service.

Next to OTTs, it is important to note that also many providers of telecommunication push into the media market offering their own IPTV solutions. As regards revenue models they usually come in a bundle with telephony and Internet access. Providers which own an electronic communication network have the natural advantage that they can offer their IPTV service as managed service i.e. monitoring and adapting the flow of data to ensure a constant high-quality consumer experience. However, since their offers are usually confined to their own network, the number of users is naturally limited and tends to be much smaller than that of OTTs. In turn, this renders them a less attractive distribution channel for producers of content.

Independent from the platform, video on demand and to some extent also traditional IPTV have distinct competitive advantages as compared to traditional TV broadcast and cable services. This has to do with their revenue models. If they support their service by advertising, they can offer a much more targeted service to businesses that takes into account the actual viewing habits of the individual and is able to make further predictions about their (dis-)likes based on a large volume of other user data. Traditional media can do this only based on samples of users and cannot individualize advertising messages. Furthermore, broadcast and cable TV's advertising revenues grow much slower than those for online advertising worldwide. In some countries they even decline due to a shift towards online advertising. Still, they have to fill their broadcast every day, which makes it difficult not to compromise the quality of content. Video on demand platforms can produce or purchase content that fits their customer segments. There is no obligation to provide a constant stream of content. It only has to be made accessible to the user. He or she watches it whenever or wherever he or she wants. This renders the cost structure in the VoD business model more manageable. In sum, it makes VoD providers well-equipped to prosper in the long-term and change the media landscape.

Especially video streaming services that seek to provide premium content face challenges acquiring premium content. On the one hand, this content is expensive, but also many content providers may be reluctant to sell premium content at all as it is their major source of income. Furthermore, there are often issues about international licensing of premium content. International distribution is, however, a key success factor for VoD services as they rely on a sufficient number of users to make their service viable. Thus, it is likely that VoD platforms more and more will rely on original content they produce themselves. Netflix and Amazon illustrate this starting trend. However, IPTV services by network operators may often not have the necessary critical mass of users nor the capabilities to produce attractive original content. Thus, if policy-makers intend to open up the media landscape to competition and foster structural change, they should make steps to facilitate international licensing of premium content and also support network operators in their move towards IPTV and VoD services.

Next to a trend towards original content, there is a trend towards differentiating digital video streaming in terms of quality of experience from broadcast and cable TV. It is already visible in Netflix' recent agreement with Sony to stream 4K video to selected high-end Sony TV sets. This will add even more data traffic to existing networks. Moving to 3D television, virtual reality entertainment and other immersive media that we are likely to see in the future will aggravate this issue further. Policy-makers and regulators will have to debate issues around cost sharing and data network infrastructure (see Section 4.2.2).

Finally, policy-makers should consider the long term evolution of consumer behaviour as regards video consumption. In total viewing hours, the trend towards VoD may still be small compared to broadcast and cable TV. However, when one turns one's attention to the video consumption behaviour of youth, it becomes obvious that this trend is all but negligible. The TV set is becoming less and less important to them as they watch an increasing volume of content on platforms such as YouTube. Often such content is

produced by small or even amateur producers. In the long run, this trend may harm the business case for established studios and producers of premium content.

5 Potential policy and regulatory implications

The present paper set out to investigate the economic influence of data and their impact on business models. The investigation of the evolutionary path of technical innovations allowing better access, distribution and analysis of data and concurring innovative business models demonstrates that a structural change towards a data-driven economy has been happening since the late 1990s. Section 3 supported this finding by developing the data value circle – a structural framework that helps to understand the specific characteristics of the data-driven economy. It proceeded by analysing the market size and prospects for each segment within the data value circle. The positive results for all segments underlined the importance of the data-driven economy and highlighted the value that data have today and are likely to have in the future. Section 4 analysed the potentially most influential value propositions within each segment of the data value circle and surrounding business models. In this analysis, but also throughout the paper potential challenges for market players, policy-makers and regulators were identified. This section summarizes challenges and strategic options for market players that have emerged from the investigations of the present paper. Hence, potentially appropriate responses by policy-makers and regulators will be sketched.

Through the course of this paper, it has become obvious that many actors within the data value circle seek to extend their businesses to other market segments in the circle. Data handling appeared to be a segment that is under a great deal of pressure. Both providers of data driven services as well as network operators have the relevant infrastructure and know-how that can be put to use relatively cheaply to also offer cloud and/or CDN services. Google is currently undercutting prices in this area and is likely to gain market share quickly. In fact, they are currently the only firm that operates in all four relevant market segments of the data value circle, albeit with relatively small operations in data networks and data handling. Amazon is possibly the second candidate to enter all four market segments. If this happens, it might at least nationally or regionally have some effect on competition, such that small innovative service providers might have to find new ways of entering the market. This situation might be aggravated if the dominance of operating (eco-)systems is furthered through the trend towards mobile devices, which might possibly result in a de facto duopoly in the online advertising market. This would make it potentially even more difficult for small firms to monetise their services through advertising.

Instead of entering other market segments themselves, the example of Netflix has shown that it can be profitable to work with partnerships. Such partnerships may also be attractive to other OTTs and to network operators. By means of such partnerships, OTT services may de facto turn into managed services. For a network operator, cost reductions are not the only opportunity to benefit from such partnerships: network operators might attract more customers by offering highly popular services such as Spotify or Netflix in their network at attractive terms and with a high quality of experience. Bundling such services with a network operator's own IPTV, access, and telephony products may positively influence customer loyalty – suggesting that IPTV and Netflix are possibly not competing, but instead are potentially complementary offerings. Depending on the terms and conditions as well as regional legislation, such partnerships may, however, be subject to regulation.

The issue of payments (e.g. for better-than-best-efforts transmission) between OTT content providers and network operators has been contentious, and is likely to continue to be a point of contention for some time. The linkage between these issues and network neutrality concerns makes them particularly difficult to resolve. It should be noted that many of the commercial parties in both camps (but not all) consider commercial (QoS-aware) agreements between willing parties to be unobjectionable. An amicable solution along those lines might perhaps be possible, but it is not likely to be easy or quick. Again, this thorny issue will not be easy to resolve.

Whether partnerships can resolve the open questions around net neutrality and the associated discussion about cost sharing of infrastructure investments between operators and OTTs is thus questionable.

However, the two issues elaborated in the above have highlighted that non-discriminatory access may not be limited to the Internet itself in the future, but rather the question of non-discriminatory access may extend into the field of market access in vertically related markets as well. Policy-makers and regulators may (depending on the specific situation in their country) see some need for intervention here. A second potentially important area of intervention emerges, when one considers this issue from a consumer perspective. One major building block of these ecosystems is lock-in effects. Policy-makers and regulators may encourage competition amongst ecosystems by supporting migration from one system to another by common standards or similar agreements (i.e. to achieve lower switching costs). If consumers can switch easily, new entrants at various levels of the value chain may find it easier to gain traction in the market.

Another incentive to enter more and more segments of the data value circle is to gain more complete insights about consumers and thus to acquire more valuable data. For network operators, an interesting strategic avenue would thus be to assess which data they can gather about consumers, and whether their behaviour might constitute a competitive advantage over the data that OTTs can gather. From a regulatory perspective, however, it is questionable whether network operators are likely to be allowed to act just as freely as OTTs do. If this is not the case, it becomes necessary to consider whether it is not time to open this competitive avenue for them. Generally, however, the collection and utilisation of more and more consumer data should be an area of concern for consumers, policy-makers and regulators alike as full personal profiles and predictive analytics may have adverse effects when put to the wrong purposes. As consumers are often unaware that data have been collected at all, which data are collected about them, and what is done with these data, transparency and information appear to be the key means of intervention here. However, to be effective information must address the consumer using terminology that is easily understood. Thus, a first step for policy-makers and regulators who wish to empower consumers and enable them to make meaningful and informed decisions about what happens to their data will be to explore how consumers conceptualise and understand the topic.

Beyond information and transparency, one might also consider steps to enable consumers to access the data that, for instance, OTTs and operators have about them. For instance, a standardised procedure could be devised to facilitate such requests for both sides. In light of a recent verdict of the European Court of Justice (giving consumers the right to demand deletion of personal data from search indices; based on the argument that search engines allow the compilation of a rather fine-grained personal profile with relatively little effort),[51] one might also ask whether consumers in countries outside of Europe should receive the right to ask for their data to be deleted, and not to be used for targeted advertising.

It is clear that the data-driven economy is very much a global economy. Data are often stored in regions with cold climate, because doing so is cheaper due to energy savings. Also, data may be routed through numerous networks until it arrives at its destination. This naturally raises questions about data security and jurisdiction.

Many of the policy interventions that could potentially be introduced to address these emerging issues are unlikely to have much effect if they are applied only on a national level. In essence, the structural change towards a data-driven economy calls for internationally agreed responses by policy-makers and regulators. Thus, consensus needs to be reached regarding governance, the organization of the process, implementation, enforcement, and cooperation for a wide range of policy interventions in order to ensure an overall positive economic effect of this structural change in the marketplace.

[51] http://curia.europa.eu/jcms/upload/docs/application/pdf/2014-05/cp140070en.pdf

GSR14 discussion paper

Using Regulatory Impact Analysis to Improve Decision Making in the ICT Sector

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 20 June 2014.

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ABSTRACT

Regulatory Impact Analysis (RIA) is defined as a systematic, structured, evidence-based analysis of the prospective impacts of a proposed policy measure against possible alternatives. First launched in the US in 1981, it has been heavily promoted by international organizations such as the OECD and the World Bank in the past three decades, and has seen successful implementation in a number of developed and also developing economies. The adoption and implementation of RIA can promote the efficiency, transparency and accountability of government action. However, implementing RIA is also challenging from a procedural and methodological viewpoint, and many countries have failed to date in their attempt to successfully mainstream this procedure into their policy cycle. This discussion paper takes stock of current RIA developments and discusses potential opportunities and challenges of the implementation of RIA in the Information and Communications Technology (ICT) sector. Several examples of application of RIA in the ICT sector are illustrated, and a check-list for regulators is presented at the end of the paper, with the aim to providing advice to ICT regulators on how to successfully use the RIA tool in their daily regulatory decisions.

USING REGULATORY IMPACT ANALYSIS TO IMPROVE DECISION-MAKING IN THE ICT SECTOR

Author: Andrea Renda, Senior Research Fellow, Centre for European Policy Studies (CEPS), Belgium

This discussion paper examines how Regulatory Impact Assessments (RIA) can make a difference in shaping sound policy and decision-making processes and regulation in the ICT sector. RIA is increasingly used as a policy tool to estimate and measure the effects of proposed or existing regulations by enabling a structured definition of the policy problem and a detailed comparison of available regulatory options. The use of RIA also marks a trend towards a more empirically-based and analytic approach to regulating the sector. It is important therefore to inform regulators on how to handle related issues in order to make the best use of tools such as RIA, and thus increase confidence in regulatory decision-making.

The discussion paper is structured as follows. Section 1 below explains what is RIA, which countries have been able to implement it successfully to date and what are the benefits associated with the use of this tool. Section 2 defines the main opportunities of using RIA within the regulatory process, and discusses links between RIA and other better regulation tools such as stakeholder consultation, monitoring and evaluation of legislation. The section also contains a reflection on the main procedural and methodological challenges that must be overcome in the implementation of RIA. Section 3 discusses the use of RIA in the ICT sector and provides some examples such as RIAs used in spectrum policy, market liberalization and roaming. Section 4 presents a regulatory checklist that can assist policymakers in the successful introduction of RIA in their own legal systems, and by advocating the use of cross-disciplinary approaches and multi-varied analysis techniques to ensure the relevance and optimize the validity of the outcomes of RIA. Section 5 concludes with a list of main findings.

1 Understanding RIA: from its origins to current practice

1.1 What is RIA and why it matters

RIA is defined at the OECD level as "a systemic approach to critically assessing the positive and negative effects of proposed and existing regulations and non-regulatory alternatives"[1]. Such a general definition is needed, since what is defined as RIA – or some of its variants, such as impact assessment (IA) in the UK or the EU, Regulatory Impact Statement (RIS) in Australia, etc. – encompasses a wide range of methods, procedures and governance arrangements, which can be so different that an authoritative academic has defined a comparative exercise as equivalent to comparing "apples with pears"[2].

Despite existing differences in the purpose, scope and methods of RIA systems around the world, RIA documents tend to follow a similar structure. The key steps of an *ex ante* RIA are the following:

[1] http://www.oecd.org/regreform/regulatory-policy/ria.htm

[2] See Radaelli, C.M. (2009), Desperately seeking regulatory impact assessments: Diary of a reflective researcher, Evaluation, 15(1), 31–48.

Phase 1. ***Problem definition***. This phase normally entails the identification of the problem. Administrations wishing to propose a new regulation are asked to identify and describe in detail the problem and its drivers. Policy problems are normally classified in two different groups: ***market failures***, including informational asymmetries, barriers to market entry, monopoly power, transaction costs and many other market imperfections that lead to inefficient outcomes; and ***regulatory failures***, which include all cases in which an existing set of rules is not achieving desirable outcomes, and as such warrants an update or a repeal. Another case in which a policy problem can be identified occurs whenever the proposing administration is confronting ***new policy targets or objectives***, and this requires new regulatory intervention: for example, if the government has set new goals in terms of broadband penetration by 2020, then – even in the absence of a market or regulatory failure – intervention might be needed in order to ensure that the new target is met. Similarly, when RIA is applied to secondary legislation, justification of policy action might be rooted in the fact that the Parliament has adopted a new piece of primary legislation, which requires implementation acts.

Phase 2. ***Identification of alternative regulatory options***. In this phase, the need for intervention has to be translated into concrete policy options. Often, available guidelines at international and national level recommend that alternatives to "heavy-handed" regulation, such as light-touch regulation, regulation through information, principles-based regulation, and alternative forms of intervention such as self- and co-regulation are duly taken into account, in order to ensure that the remedy chosen is not disproportionate to the problem at hand.

Phase 3. ***Data collection***. This is a crucial phase, which may entail (besides desk research) a variety of empirical methods, from telephone and face-to-face interviews to the distribution of questionnaires, organization of online surveys and consultations, cooperation between regulatory authorities (*e.g.* ministries, custom authorities, police, etc.), focus groups, Delphi methods, stopwatch methods (especially in administrative burdens measurement), etc.[3] The amount of data needed and the method used to collect it vary from case to case, and should not be disproportionate to the RIA: data and information available are normally intended as functional to the accuracy of the assessment phase that follows. When data is missing, economic modeling is also possible, especially through behavioral models such as those used in the law and economics literature[4]; and through econometric modeling.

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[3] The Delphi method is a structured communication technique, originally developed as a systematic, interactive forecasting method which relies on a panel of experts. The experts answer questionnaires in two or more rounds. After each round, a facilitator provides an anonymous summary of the experts' forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. It is believed that during this process the range of the answers will decrease and the group will converge towards the "correct" answer. Finally, the process is stopped after a pre-defined stop criterion (e.g. number of rounds, achievement of consensus, stability of results) and the mean or median scores of the final rounds determine the results. A stopwatch method entails the simulation of a given activity aimed at measuring the time needed for each of the activity's phases.

[4] An example is found in the Impact Study "Making private antitrust damages actions more effective in the EU", coordinated by Andrea Renda at CEPS, where the impact of fee-shifting rules has been

Phase 4. ***Assessment of alternative options***. This is a core phase of the RIA, and can be carried out through different techniques – the most common being cost-effectiveness analysis (CEA), cost-benefit analysis (CBA), and risk analysis. Options scrutinized always have to include the "zero option", sometimes referred to as "baseline" or "no policy change" scenario, which should not be confused with the "status quo" scenario, since it captures the evolution of the policy problem absent new regulatory intervention[5]. Depending on the available data and the depth of the RIA exercise, the assessment can be qualitative or quantitative, or a mix of the two.

Phase 5. ***Identification of the preferred policy option***. Once the available options have been carefully scrutinized, the comparison leads to the identification of the most preferred option. This is not necessarily the options that should be undertaken, as RIA *per se* is only a support to, not a replacement of, the policymaker's role in selecting the most appropriate action. International guidance documents often recommend that the preferred option is subject to a more in-depth assessment, mostly aimed at quantifying the prospective impacts.

Phase 6. ***Provisions for monitoring and evaluation*.** As increasingly required in national RIA systems, the RIA document should also specify the ways in which the impact of the selected policy action can be monitored overtime, and a clear and efficient time horizon for revision of the action in the future. In addition, whenever indicators can be selected at the *ex ante* stage, this facilitates the *interim* and *ex post* evaluation of the selected action, which should follow the *ex ante* phase.

1.1.1 What are the expected benefits of RIA?

RIA can be a time-consuming exercise and normally requires changes in the institutional setting and in the behavior of civil servants, away from procedure-oriented and towards a more performance-oriented, results-based mindset. The expected benefits of implementing a RIA system are of three main types:

- **Efficiency**. When RIA makes use of methods such as CBA and CEA, its use should help administration decide in favor of more efficient policy options, discarding less efficient alternatives. Over time, is correctly implemented, this should lead to greater social welfare through an increase in the net benefits of public policies. However, as will be explained in more detail below, it must be recalled that the notion of efficiency in economics often disregards distributional impacts. For example, when working only on the basis of efficiency, ICT regulators might prefer options that maximize net benefits but do not lead to universal access to broadband, over options that guarantee access to all citizens to at least basic broadband.
- **Transparency**. RIA can increase the transparency of public policy since it forces public administrations to motivate their actions in writing, and by explaining why the proposed course

estimated through benchmarking with other jurisdictions (US) and through law and economic models. (IF parts of this is based on previous work done, say it up front.)

[5] The status quo option refers to the situation at the moment in which the IA is carried out. The "no policy change" option implies an assessment of the likely evolution of the market at hand absent specific regulatory intervention. Again, see the Impact Study "Making private antitrust damages actions more effective in the EU" for a discussion and an application.

of action is more desirable than available alternatives, including the option of doing nothing. This way, administrations do not present themselves anymore as "black boxes", which take decisions with no explicit, structured justification. Of course, the transparency effect of RIA is more significant whenever RIA documents are made public: without adequate publicity of RIA documents, most of the added value of the procedure might fade away, as the possibility for stakeholders to access the content of the RIA (possibly when the document is still in progress) provides stimulus to the administrations that draft the document. In some countries (*e.g.*, Italy), the quality of RIA has remained low also as since the government has never decided to publish documents online.

- **Accountability**. The use of RIA also promotes the accountability of governments, *i.e.* their responsibility for the outcomes generated by policy. This occurs in particular when administrations that propose new regulations or legislation draft their own RIA, and the latter becomes a key input for the drafting of the rules. The accountability effect is also stronger when governments commit to monitor the impacts of the proposed rule and evaluate it over time, within the so-called "policy cycle" (see below, Section 1.1.2). Accountability is weaker whenever

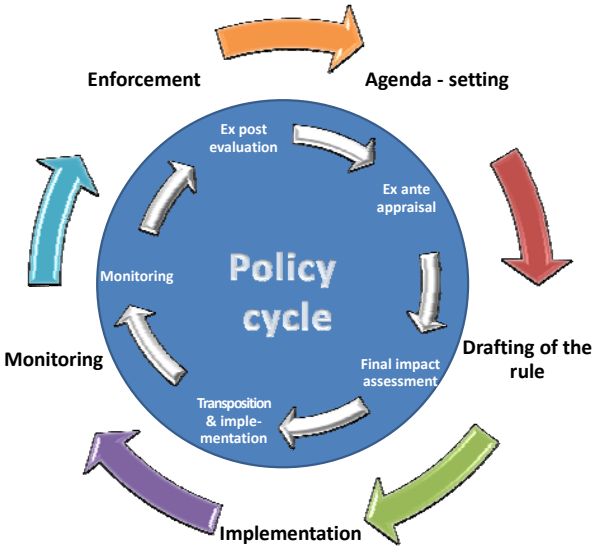
Besides these widely acknowledged benefits, it must be recalled that the wider benefits of adopting RIA are often very difficult to communicate, especially since it is very difficult to establish a counter-factual scenario. Ironically, RIA demonstrates its value added more clearly whenever it leads to the rejection of a proposal, rather than when it leads to adoption. Unfortunately, the former case is uncommon at best.

Against this background, it is possible to state that the benefits of RIA, although difficult to communicate, are evident whenever RIA provides an input to a proposal that will not be modified at a later stage, for example in Parliament. For example, the European Commission performs RIA on its major proposals, but the latter are most often heavily amended by the European Parliament and the Council of the EU before they become legislation..

1.1.2 RIA in context: the "policy cycle"

Too often, RIA has been implemented "in isolation". This is a recipe for failure, since RIA alone cannot produce its intended transparency, accountability and efficiency effects. To the contrary, countries that have introduced RIA alongside with a thorough public management reform and a holistic view of the policy cycle have reaped the benefits of a full-fledged regulatory management system. More specifically, the so-called "policy cycle" includes both tools for the *ex ante* analysis and for the *ex post* evaluation of public policy; and both tools for the analysis of the flow of individual policy measures, and the *stock* of the existing corpus of legislation in given sectors. For what concerns the life of an individual rule, figure 1 below shows both the policy cycle (outer circle) and the cycle of smart regulation tools that accompany each phase (inner circle). As shown in the figure, the outer circle distinguishes between the agenda-setting phase of legislation (often, coinciding with preparatory documents or primary legislation), the drafting of individual rules, the implementation phase, the monitoring of compliance and the enforcement of the rule itself. Against this background, a responsive administration performs an *ex ante* RIA of preliminary phases, but also provides for monitoring and evaluation indicators and an ex post evaluation, which itself leads to the identification of the need for further action and a new *ex ante* assessment phase.

Figure 1 – The "policy cycle"



Source: Author .

RIA can become an integral part of a regulatory management system whenever it:

- Incorporates the results of a sound consultation process;
- Contains indicators for monitoring the legislation at hand over time;
- Contains a "review clause" which sets a timeframe for evaluating the performance of the legislation over time (e.g. after 5 years).

This way, RIA becomes a very important piece of a broader puzzle, in which administrations behave responsible in all phases of the policy cycle and learn from possible mistakes in the adoption of policies by reacting promptly to policy failures and communicating to stakeholders the reasons for changes in policy.

1.2 International RIA models

RIA was first introduced in the United Stated in 1981. Another early adopter of a RIA requirement was Australia (1985). By the mid-1990s approximately 12 OECD countries had implemented RIA requirements of some form, although the scope of the required analysis varied considerably. By 2000, 20 of 28 OECD countries had implemented RIA requirements. Currently, virtually all OECD countries use RIA. RIA requirements had also begun to be strongly promoted to its client countries by the World Bank. As a result, an increasing number of developing countries have now adopted RIA requirements.

1.2.1 The US RIA model: a brief introduction

The main reasons that led to the introduction of RIA were: (i) the need to ensure that federal agencies belonging to the government in the US would justify the need for regulatory intervention

before regulating, and would consider light-touch means of intervention before engaging into heavy-handed regulation; (ii) the need for the centre-of-government to control the behavior of agencies, to which regulatory powers have been delegated[6]; and (iii) the need to promote the efficiency of regulatory decisions by introducing an obligation to perform cost-benefit analysis within RIA.

Underlying the introduction of RIA was, from a more general viewpoint, the idea that policymakers should be led to take informed decisions, which are based on all available evidence. In the case of the United States, this idea was initially coupled with a clear emphasis on the need to avoid imposing on the business sector unnecessary regulatory burdens, a result that was in principle guaranteed by the introduction of a general obligation to perform cost-benefit analysis of alternative regulatory options and justify the adoption of regulation on clear "net benefits". Although the US system has remained almost unaltered, the initial approach was partly modified the emphasis was shifted from cost-reduction to achieving a better balance between regulatory costs and benefits.

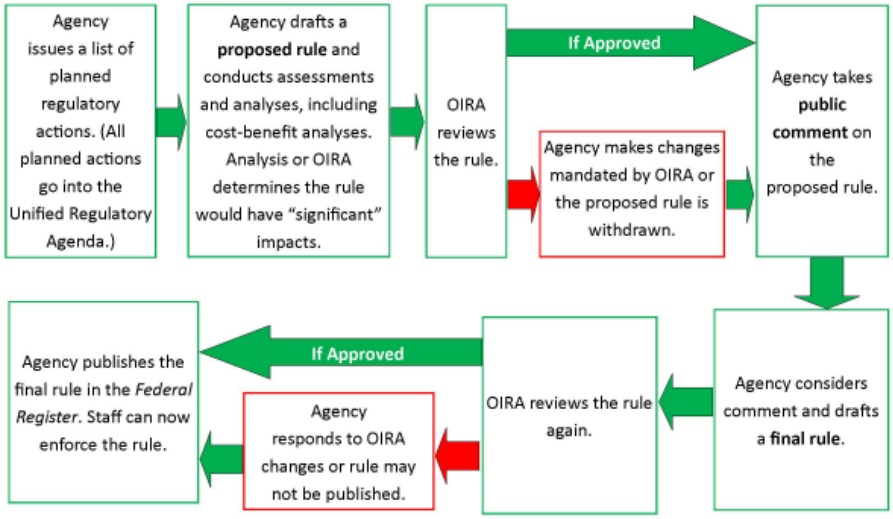
The first steps of RIA were also accompanied by a reform of the governance arrangement adopted by the US administration for the elaboration of regulatory proposals. As a matter of fact, as will be recalled more in detail below, RIA cannot exist in isolation, and requires suitable institutional and organizational arrangements. In the case of the US, the most notable features of the system were the following:

- ***RIA was introduced as a mandatory procedural step in an already existing set of administrative rules***. In particular, the 1946 Administrative Procedure Act already mandated that draft regulatory proposals presented by Federal agencies ("Notice of Proposed Rulemaking", NPRM) be published for consultation period termed "notice and comment". From 1981, the RIA document has to be attached to the NPRM as an explanatory document, which can enable more structured and informed comments on the side of stakeholders.
- ***The introduction of RIA required the creation of a central oversight body in charge of scrutinizing the quality of RIAs produced.*** Put simply, the center-of-government cannot pretend to have the same level of specialization of Federal Agencies such as, *e.g.*, the Environmental Protection Agency for environmental issues or the Department of Transportation for transport-related issues. However, if these agencies are asked to complete a cost-benefit analysis in support of their policy decision, an economist would be able to read it and evaluate its quality. This is why the Office of Information and Regulatory Affairs (OIRA) was created, which since then receives and scrutinizes all regulatory proposals filed by the agencies and issues an opinion which – although not binding – normally strongly affects the decision whether to move on with the regulatory proposal, or revise it together with the underlying RIA[7].

Figure 2 below shows the basic rulemaking process for significant rules in the United States.

[6] Posner, E.A. (2001), Controlling Agencies with Cost-benefit Analysis. A Positive Political Theory Perspective, University of Chicago Law Review, Vol. 68, 2001.

Figure 2 . Federal rulemaking process in the US: main steps for significant rules



Source: US Center for effective government

Since 1981, thousands of RIAs have been produced by US agencies, and many of them have gained considerable knowledge in the practice of cost-benefit analysis. Our brief analysis of the US RIA model, however, reveals a number of specific peculiarities, which should be duly taken into account in assessing the possibility to "export", or "transplant" the US model into other countries.

- ***Narrow scope*.** In the US RIA is mandatory only for Federal agencies and thus only for secondary legislation proposed by these agencies. Neither regulation by independent agencies (e.g. the Federal Trade Commission, the Securities and Exchange Commission, the Federal Communications Commission), nor primary legislation discussed in Congress (e.g. the Affordable Healthcare Act or "Obamacare") are subject to an obligation to perform RIA. Moreover, since the Clinton administration the scope of the system has been further narrowed down since only the "major" new federal regulations were made subject to the obligation to carry out RIA. These are regulations that meet certain characteristics, including an expected impact of at least 100 million USD[8].
- ***A focus on cost-benefit analysis***. The US RIA system is clearly and explicitly based on the practice of cost-benefit analysis (CBA). This is intimately related to the rather narrow scope of the system: as a matter of fact, as will be illustrated below, CBA is often considered unfit for primary legislation, since it does not take into account distributional impacts, and requires the monetization of all costs and benefits associated with the proposed regulation. Using CBA for

[8] More specifically, RIAs are mandatory for government agencies only when they refer to 'significant regulatory actions' – i.e., those that: i) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; ii) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; iii) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or iv) raise novel legal or policy issues arising out of legal mandates, the President's priorities or the principles set forth in EO 12,866.

secondary legislation is, to the contrary, more widely accepted given that the distributional consequences of regulation are less apparent and are normally rooted in the underlying piece of primary legislation: that said, the use of CBA in the US RIA system is still subject to a hectic debate in the US[9].

- ***A presidential democracy***. The introduction of RIA in the US, as well as the specific features of the US system, strongly depend on the fact that the It, in the US, as was remarked by authoritative scholars, the RIA system became a fundamental element of a "principal-agent" mechanism, in which the principal (the White House) sets priorities and outcomes, and agents (the Federal Agencies) regulate to meet those priorities and outcomes. RIA is thus a way to better control the agents, and ensure that their incentives are aligned with those of the principal[10].

These and other circumstances – *i.a.*, the fact that CBA can be scrutinized by courts, the existence of remarkable competences and skills in both OIRA and the agencies, and the outstanding development of universities, research centers, think tanks and other stakeholders table to contribute their opinion to the "notice and comment" procedures – make the US RIA system a rather peculiar experience, very difficult to replicate in other countries. However, this has been often disregarded in the international experience, as will be made clearer below.

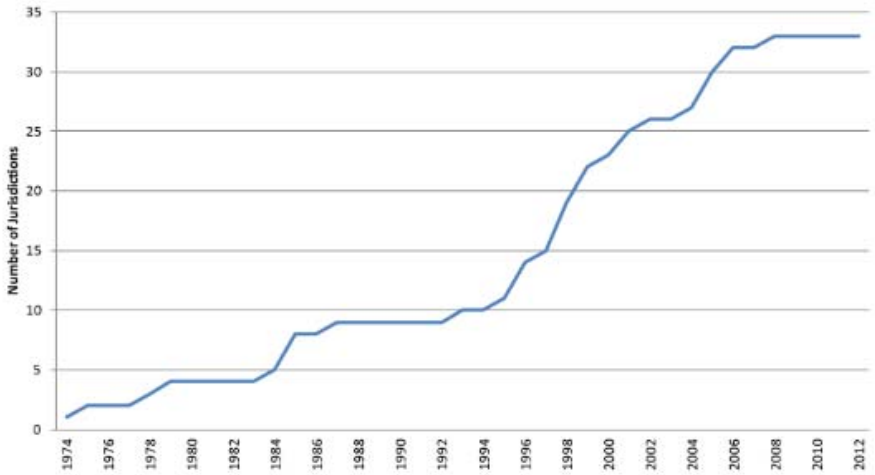
1.2.2 RIA around the world: developed economies

In the past three decades, several governments have adopted procedures aimed at ensuring a more regular and structured use of economic analysis in support of regulatory decisions. As shown in figure 2 below, between 1974 and 2012 the number of OECD countries with a formal requirement to perform RIA in support of public regulatory decisions increased from 1 to 33. Also, many developing countries – often funded by international donors such as the World Bank, the Asian Development Bank or the Inter-American Development Bank – have experimented with RIA in the past two decades, with alternate fortunes. The introduction of RIA has very seldom included the ICT sector, at least as primary concern. Most often, in developing countries emphasis is placed on reforms aimed at the simplification of business-related legislation, rather than on individual sectors such as ICT. We will get back to this in more detail in Sections 3 and 4 below.

[9] See section 2.2. below For an illustration of the methodological challenges of using cost-benefit analysis.

[10] See Posner (2001), *supra* note 10.

Figure 3 – OECD Countries with a formal requirement for RIA, 1974-2012



Source: OECD

Among the most successful RIA experiences to date, besides the US one, it is possible to mention the UK, Canada and Australia. In all these countries, RIA is used systematically and has been successfully mainstreamed into the policy cycle of government.

In **Canada,** almost all new federal regulations are required to have a Regulatory Impact Analysis Statement (RIAS), which are made up of six parts: Description, Alternatives, Benefits and costs, Consultation, Compliance and enforcement, and Contact. A detailed seven-step procedure exists the pre-publication phase of regulatory proposals, which includes a "triage" procedure for the determination of the level of impact generated by the proposal, coordinated by the Regulatory Affairs Sector of the Canadian Treasury Board Secretariat. Interestingly, the Canadian Treasury Board Secretariat follows a life-cycle approach to regulatory management and has created a Centre of Regulatory Expertise (CORE) to assist in the gradual development of expertise on better regulation inside the administration. CORE provides expert advice and services to help departments build their internal capacity to develop sound, evidence-based regulatory proposals. CORE experts offer guidance on analytical services (especially risk assessment, cost-benefit analysis, performance measurement, evaluation plans), coaching and advisory services, workshops and presentations, and peer review services[11].

In **Australia**, Regulatory Impact Statements follow seven steps: problem definition, objectives, options, impact analysis, consultation, conclusion and Recommended Option and provisions for implementation and review. The Government has agreed that, in the absence of exceptional circumstances as confirmed by the Prime Minister, a regulatory proposal with likely impacts on business or the not-for-profit sector that are not minor or machinery cannot proceed to the Cabinet or other decision makers unless it has complied with the RIA Framework. Currently, where a RIS is required for a regulatory proposal to be considered by Cabinet, the RIS (assessed as adequate by OBPR) must be circulated to agencies preparing coordination comments on the Cabinet submission.

[11] See www.regulation.gc.ca.

The RIS is to be made available to Cabinet, preferably attached to the final Cabinet submission or memorandum[12].

In **Mexico,** RIA has been applied for more than a decade and was recently reformed to align it with OECD best practice. The National Regulatory Improvement Commission (COFEMER) exercises quality controls of new and existing regulations by issuing opinions on the drafts and RIAs prepared by line ministries and regulators[13]. COFEMER's opinions are not legally binding: nevertheless, given that all of COFEMER's opinions, as well as the draft regulations and RIAs, are public, in the majority of cases, line ministries and regulators do follow its opinions. In addition, COFEMER's final opinion is a requisite to publish regulation in the Official Journal of the Federation (DOF), which is absolutely necessary to provide the regulation with binding power and legality.

In the **United Kingdom,** Impact Assessments are generally required for all Government interventions of a regulatory nature that affect the private sector, civil society organizations and public services. The procedure was initially limited to the assessment of compliance costs for the business sector, and since 1998 evolved into a full-fledged system of cost-benefit analysis. Today, RIA is a common practice in many sectors, including ICT: a peculiarity of the UK is that the telecommunications regulator OFCOM has published in 2005 a document describing its own approach to RIA[14].

In the **European Union,** an impact assessment system was introduced in 2002. The EU peculiarity is that the system applies to all major new policy initiatives of the European Commission, from soft law documents (Communications, recommendations) to far-reaching, cross-cutting new EU directives and regulations. Since 2003, almost 900 impact assessments have been completed by the European Commission, and from 2012 onwards also the European Parliament has created an internal Directorate for Impact Assessment (IMPA), which started to commission in-depth analyses of European Commission RIA documents, and performs RIAs on major amendments proposed by members of the European Parliament, including of course all proposals that affect the ICT sector.

In **the Republic of Korea,** months after his inauguration, President Kim directed the cabinet to cut the existing regulations by half. The initiative was driven by the newly-created Regulatory Reform Committee (RRC) following the 1997 crisis. In Korea, political support did not wane as time passed, as this policy agenda was supported by a strong constituency. When a few months later RRC reported lukewarm results achieved by ministries and agencies, the President ordered them to resubmit the plans so that the existing regulations could be cut down by more than 50% by the end of 1998 (OECD, 2007). According the basic Act on Administrative Regulation (BAAR), every regulatory body in Korea is compelled to conduct RIA whenever proposing new or revised regulations. RRC is in charge of guiding, advocating and reviewing regulatory bodies to conduct RIA through publishing the RIA guidance. In order to increase regulatory transparency, since July 2006 the Korean government has opened RIA reports to the public through ministries' websites during the public notice period of

[12] See Borthwick, D. and Milliner, R. (2012), Independent Review of the Australian Government's Regulatory Impact Analysis Process, April.

[13] The COFEMER was created in year 2000, through a reform to the Federal Administrative Procedures Law. It is an autonomous agency of the Ministry of the Economy, and is supported by the Federal Regulatory Improvement Council which is comprised by five ministries, a number of government agencies, as well as representatives of the private and social sectors, and scholars. It employs 60 professionals, mainly experienced on fields such as Economics and Law.

[14] See http://stakeholders.ofcom.org.uk/binaries/consultations/better-policy-making/Better_Policy_Making.pdf

proposed regulations which is 20 days. If proposed regulations affect foreign parties, ministries are recommended to extend the public notice period to 60 days

In **New Zealand,** the government explicitly stated that it expects that departments will not propose regulatory change without clearly identifying the policy or operational problem it needs to address, and undertaking regulatory impact analysis (RIA) to provide assurance that the case for the proposed change is robust; and careful implementation planning, including ensuring that implementation needs inform policy, and providing for appropriate review arrangements. The government's RIA framework encourages an evidence-based approach to policy development which helps ensure that all practical options for addressing the problem have been considered and the benefits of the preferred option not only exceed the costs, but will also deliver the highest level of net benefit. RIA should be undertaken for any policy work involving regulatory options that may result in a paper being submitted to Cabinet. "Regulatory options" means the potential introduction of new legislation (bills or regulations) or changes to/the repeal of existing legislation. This analysis involves the preparation of a Regulatory Impact Statement (RIS) that summarizes the RIA that has been undertaken. Certain information about the RIA undertaken must also be included in the Cabinet paper. A RIS is normally provided when papers are submitted to Cabinet committees for policy approval. In rare circumstances, the policy proposal and draft regulations may be submitted together. In these cases, the usual procedure is for the paper to be submitted to the relevant 'policy' Cabinet committee, rather than directly to the Cabinet Legislation Committee.

1.2.3 RIA around the world: emerging and developing countries

Among emerging economies and developing countries, there are several examples of attempts to introduce RIA as a systematic assessment of the impacts of proposed new legislation or regulation. Back in 2005, Ladegaard (2005) observed that "*a quick scan of easy-available sources suggests that RIA in one form or the other is carried out in, among others, Tanzania, Uganda, Bulgaria, Croatia, Serbia, Romania, Estonia, Lithuania, Latvia, Poland, Mexico, South Korea, the Philippines, Algeria, Botswana, Jamaica, Albania, South Africa, Sri Lanka and Ghana*". Since then, new countries have added to the list. More in detail:

- In Latin America, countries like **Brazil, Chile, Colombia, Costa Rica, Ecuador** are currently trying to introduce more systematic use of RIA in their administrations[15].
- In Asia, *i.a.* **Cambodia, Lao PDR, Malaysia, Mongolia, Philippines** and **Vietnam** are piloting regulatory impact assessment to assure quality of new regulations and improve the business climate. The Philippines and Malaysia have also established national level bodies made up of senior figures from the public and private sectors to assist in various regulatory reform efforts[16].
- In Africa, among others, **Botswana, Egypt, Uganda**, **Ghana, Nigeria** and **Tanzania** have run pilot projects to implement RIA. In **South Africa,** RIA was approved by Cabinet in February 2007,

[15] See the report by the COFEMER, Reforma Regulatoria an America Latina, available online at http://www.cofemer.gob.mx/images/cofemer/ReformaRegulatoria_AL.pdf.

[16] See OECD, Summary of the Regulatory Reform Dialogue at the 2014 OECD Southeast Asia Regional Forum 10th meeting of the Regulatory Policy Committee, 14-15 April 2014, The OECD Conference Centre, Paris, France, GOV/RPC (2014)8, available online at the following website: http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=GOV/RPC(2014)8&docLanguage=En

following a detailed joint study commissioned by the Presidency and the National Treasury to investigate the possibility of introducing RIA. Guidelines are available since 2012[17].

In many of these countries, the introduction of RIA occurred within the context of "ease of doing business" reforms, in particular in support of legislation on streamlining business licensing systems. The problem that emerged in most of these cases is the lack of a more comprehensive long-term strategy to mainstream RIA within the policy process of the country at hand. This inevitably led to the loss of momentum of RIA once those initial pilots have expired. A recent workshop organized in Pretoria, South Africa by the EU-funded project LIAISE led to similar conclusions[18].

2 RIA: main challenges and lessons learnt

Thirty years of experience with RIA have led to a better understanding of how, and under what circumstances, RIA can become a driver of regulatory quality and, eventually, of better regulatory outcomes for society as a whole. Still, today many countries feature a significant "adoption-implementation gap", which implies that the challenges to be overcome to successfully mainstream RIA within the regulatory process are tough and difficult to overcome. As a matter of fact, there is no "one-size-fits-all" set of steps that should be followed to successfully implement RIA: national strategies should account for the legal tradition, political features and many other specific aspects to be successful.

Below the main procedural and methodological challenges that are associated with the adoption and implementation of RIA are summarized.

2.1 Procedural and organizational challenges

One of the main procedural challenges in the introduction of RIA is the need for well-designed **legislative/regulatory planning**. In many countries the regulatory process is too chaotic and last-minute to leave time for the preparation of a RIA document; this, in turn, means that countries that cannot guarantee an orderly planning of the legislative or regulatory activities, RIA will find enormous difficulties.

Second, the implementation of RIA requires adequate **governance arrangements**, and in particular the existence of a **regulatory oversight body** in charge of guiding administrations in the drafting of RIA, advocating changes in legislation and scrutinizing the quality of the RIA documents that are produced. Oversight bodies are generally located close to core executive functions: either at the center of government itself, or as part of central ministries. Their core functions are co-ordination and supervision, challenge and scrutiny, training, advice and technical support and advocacy.

Third, RIA requires a wide **acceptance in the administration**. Very often, civil servants are hostile to the adoption and implementation of RIA, which they see as yet another administrative requirement

[17] See Guidelines for the implementation of the Regulatory Impact Analysis/assessment (RIA) process in South Africa (2012), available online at the following website: http://www.thepresidency.gov.za/MediaLib/Downloads/Home/Publications/RegulatoryImpactAssessment/Guidelines2/Regulatory%20Impact%20Assessment%20Guideline%20February%202012.pdf

[18] See http://beta.liaise-toolbox.eu/content/liaise-workshop-regulatory-impact-assessment-developing-and-emerging-countries-held-pretoria.

in their often already heavy procedures. This problem often takes time to overcome: however, the more civil servants are made accountable for their actions, the more they are observable by external stakeholders, the more they will find that RIA is their ally, rather than an enemy.

Fourth, RIA requires **adequate skills**. This does not mean that all civil servants drafting RIA should be Ph.D. economists: what is needed is familiarity with the types of mechanisms at hand when policy measures enter into force. Many officers in administrations tend to have limited knowledge of all the types of costs and benefits that can be generated by legal rules, and often ignore the spillover or indirect effects generated by rules.

Finally, RIA requires **transparency in the administration and accessibility of public information**. In many countries, access to information produced by governments is still restricted, which in turn can undermine the credibility of the RIA exercise. To the contrary, countries that give themselves minimum standards for consulting stakeholders and rules governing access to information (e.g. a "freedom of information act") can harness more easily the potential of RIA as a tool to streamline the policy process.

2.2 Methodological challenges

Besides procedural and organizational issues, RIA also faces very significant methodological challenges, which can be summarized as follows.

- ***Get the scope right: primary v. secondary legislation.*** It is very important that policymakers identify the scope of the RIA mechanism they wish to introduce. As mentioned above, the original US RIA model was made applicable only to secondary legislation. In other countries, RIA was made applicable also to primary legislation proposed by government decree; and fewer countries have attempted to introduce RIA in parliaments. It is very important to recall that, depending on the type of legal instrument at hand, the methods used to compare regulatory options and even the presentation of the preferred policy option may change. The introduction of an obligation to perform RIA in national parliaments (and even most notably in the European Parliament) has often faced almost insurmountable difficulties. In the field of ICT, a key choice is whether to make RIA mandatory for the general framework legislation (e.g. the telecommunications law, or a country's digital agenda), and/or for individual regulatory decisions (e.g. setting termination rates, or choosing between modes of spectrum allocation),
- ***Get the scope right: all regulations or only major ones?*** Administrations wishing to introduce RIA have to choose whether to make RIA compulsory for all acts of regulation, or only for the most important ones. Most countries opted for the latter solution, also given the fact that RIA takes time and resources to complete, and in some cases the benefit of carrying out RIA might not justify the corresponding cost. One key trade-off that governments face is whether to set a minimum threshold for the obligation to perform RIA (as in the US, where significant rules that undergo RIA are defined also by means of a quantitative threshold); or whether to introduce a "principle of proportionate analysis", which makes the depth of the RIA exercise dependent on the expected impact of the proposal[19].

[19] The principle of proportionate analysis is explained in the European Commission Impact Assessment Guidelines. The Guidelines explain that the "proportionate level of analysis" is not only about the depth and scope of the analysis or the drafting of the IA report. It refers to the whole IA process - data collection efforts and stakeholder consultation, the level of ambition of the objectives, options and

- ***Choose the methodology carefully*.** Very often RIA is equated with the practice of cost-benefit analysis: this statement however is incorrect, since RIA can host a variety of methodologies, which can be chosen according to the type of analysis to be performed. In general, the choice of the methodology depends on the types of impacts to be assessed, their extent, and the likelihood that the regulatory proposal generates substantial indirect costs and benefits. The following methodologies are most often used in RIA:
    - *Least-cost analysis.* When the benefits of a given regulatory intervention are set, the analysis should focus on achieving those benefits at the least possible cost;
    - *Cost-effectiveness analysis*. Especially when RIA refers to public expenditure, options might be compared based on their "value for money". This means that the choice of the preferred option will be made based on the so-called "benefit/cost ratio", *i.e.* dividing expected benefits by the corresponding costs. Cost-effectiveness analysis does not require that benefits are expressed in monetary values: for example, two options could be compared based on how many lives they save per dollar spent.
    - *Cost-benefit analysis* requires that all major direct and indirect costs and benefits of the alternative regulatory options are identified and monetized. The option that features the highest net benefits – *i.e.*, benefits minus costs – will be considered as the most efficient and thus the preferred one. Given the need to monetize both costs and benefits, cost-benefit analysis can be challenging and has been heavily criticized as a basis for policymaking, especially when distributional impacts are significant (see box 1 below).
    - *Multi-criteria analysis* allows a comparison of alternative policy options along a set of pre-determined criteria. For example, criteria chosen could include the impact on SMEs, the degree of protection of fundamental rights, consumer protection, etc. Multi-Criteria Analysis is particularly useful when RIA has to be reconciled with specific policy objectives, and as such is used as an instrument of policy coherence. This method is more likely to capture distributional impacts, although this crucially depends on the criteria chosen for evaluating options. For example, in the ICT sector the criteria chosen to analyze options could include universal access, affordability, incentives to invest in new technologies/infrastructure, interoperability, etc.

Box 1 – When to use Cost-Benefit Analysis

There are pros and cons of choosing CBA as the method to be used in comparing policy proposals. The pros mostly lie in the ability of CBA to use an objective unit of measurement (monetized values) to compare alternative options and choose the one that maximizes the "size of the pie", i.e. societal welfare as described in mainstream economics. The shortcomings, however, are often quite critical for CBA, and mostly refer to the assumption that income can be a proxy for happiness or satisfaction, the fact that it willingly ignores distributional effects (despite some attempts to adjust the methodology to reflect them), and its lack of objectivity when it comes to the selection of certain

delivery mechanisms, the type of impacts to be examined, and the arrangements for monitoring and evaluation. While clarifying that it is the responsibility of the author service to determine the level of analysis, the Commission observes that this decision should be based on the significance of likely impacts, the political importance of the initiative and also on where the initiative is situated in the policy development process. See SEC(2009)92, at Section 3.2.

parameters (e.g. the inter-temporal discount rate), which can tilt the balance in favor of certain regulatory options over others.

Based on these descriptions, one should choose cost-benefit analysis as the method to be used to compare alternative policy options if:

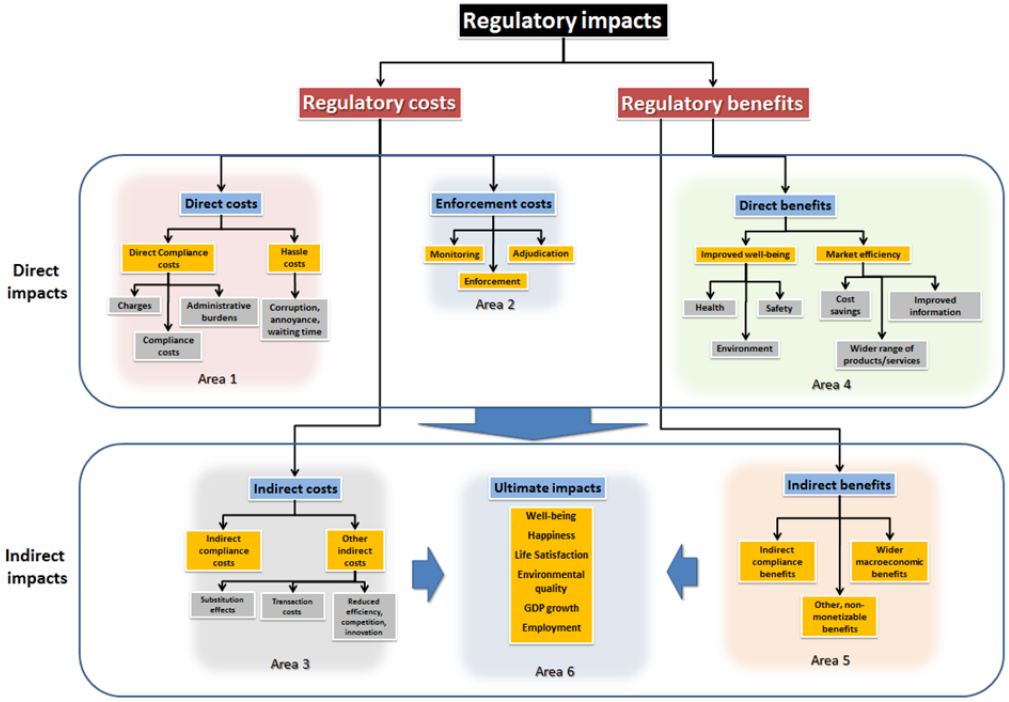
- ***Both benefits and costs vary*** depending on the regulatory alternative chosen (if not, consider least-cost analysis).
- ***At least all direct benefits and direct costs can be monetized***, covering where possible the economic, social and environmental impacts of the proposal at hand (if benefits can be quantified, but not monetized, consider cost-effectiveness analysis): this requires an assessment of data availability in order to understand whether CBA will be feasible within a reasonable time frame.
- ***The expected magnitude of impacts justifies the effort and time needed to perform CBA*** (as a full-fledged CBA is normally more time-consuming than other, more qualitative techniques). Similarly, the choice to perform cost-benefit analysis must be read also in light of the application of the principle of proportionate analysis, which means that the depth of the cost-benefit analysis exercise, as well as the time and the resources devoted to it, must be made dependent *i.a.* on the type of proposal at hand (e.g. whether binding or not binding, whether cross-cutting or narrow), as well as on the *prima facie* expected impact of the proposal.
- ***Distributional impacts are unlikely to be substantial*** (otherwise, consider multi-criteria analysis, or break down CBA by affected stakeholder without aggregating costs and benefits into a net benefits analysis).

Source: Author.

2.2.1 Identifying the costs and benefits of regulation

Regardless of whether RIA is eventually based on CBA or not, it is always essential to identify all relevant direct and indirect costs and benefits that would emerge if the available regulatory options are implemented. This can enable a more meaningful comparison of regulatory options. Figure 4 below shows a general map of the impacts generated by legal rules. This map is intended for ease of visualization of the full landscape of regulatory impacts: as such, it should be taken as a tentative exercise, not as an attempt to establish once and for all the categories of costs and benefits that can emerge from regulation (as a matter of fact, guidance documents on impact assessment and cost-benefit analysis from all over the world show different taxonomies and typologies of costs and benefits).

Figure 4 – A map of regulatory costs and benefits



Source: Renda *et al.* (2014)

As shown in the figure, legislation normally produces both direct and indirect impacts, which in turn can generate second-order effects ("ultimate impacts"). More in detail, Figure 4 highlights six main areas of regulatory impacts. For what concerns costs:

- ***Area 1 includes direct costs from regulation (DC)***, such as direct compliance costs and hassle/irritation burdens.
    - *Direct compliance costs* include:
        - *Regulatory charges*, which include fees (such as spectrum and licensing), levies (e.g. copyright levies), taxes, etc.
        - *Substantive compliance costs*, which encompass those investments and expenses that are faced by businesses and citizens in order to comply with substantive obligations or requirements contained in a legal rule (e.g. the need to install new equipment to avoid interference between co-primary uses of the 700 MHz band); and
        - *Administrative burdens* are those costs borne by businesses, citizens, civil society organizations and public authorities as a result of administrative activities performed to comply with information obligations included in legal rules (e.g. keeping records of security incidents and notify each breach of security to public authorities).

  - *Hassle costs* are often associated with businesses, but they apply equally well to consumers: they include costs associated with waiting time and delays, redundant legal provisions, corruption etc.

- ***Area 2 refers to enforcement costs (EC)***. These costs are often downplayed in *ex ante* RIA. They refer to key phases of a rule's life such as monitoring, enforcement and adjudication. They include costs related to dispute resolution, litigation, appeals, government inspections, etc.
- ***Area 3 encompasses indirect regulatory costs (IC)***, which refer to costs incurred in related markets or experienced by consumers, government agencies or other stakeholders that are not under the direct scope of the regulation. These costs are usually transmitted through changes in the prices and/or availability and /or quality of the goods or services produced in the regulated sector. Changes in these prices then ripple through the rest of the economy, causing prices in other sectors to rise or fall and ultimately affecting the welfare of consumers[20]. This costs also include the so-called "indirect compliance costs" (*i.e.* cost related to the fact that other stakeholders have to comply with legislation) and costs related to substitution (e.g. reliance on alternative sources of supply), transaction costs and negative impacts on market functioning such as reduced competition or market access, or reduced innovation or investment. For example, if a given auction design generates costs for telecom operators, which are likely to be passed-on downstream in the form of higher retail prices for consumers, this should be counted as an indirect regulatory cost.

Performing an ex ante RIA requires constant awareness of the fact that total costs arising from a given regulation are given by the following sum: (**DC + IC + EC**). Any assessment that partly or fully, intentionally or inadvertently omits the analysis of one or more of these categories of costs is likely to provide an incomplete, and thus inaccurate account of the costs generated by the legal rule.

For what concerns benefits, Renda et al. (2014) suggest the following categorization:

- ***Area 4 includes direct regulatory benefits***. Here, the following categories of benefits can be distinguished:
  - The improvement of the well-being of individuals, which in turn encompasses social and economic condition as well as health, environmental and safety improvements; and
  - Efficiency improvements, which include, notably, cost savings but also information availability and enhanced product and service variety for end consumers, and greater productivity (as is often the case when a proposal generated enhanced access to, and usage of, ICT).
- ***Area 5 includes indirect regulatory benefits***, which encompass:
  - Spillover effects related to third-party compliance with legal rules (so-called "*indirect compliance benefits*");
  - *Wider macroeconomic benefits*, including GDP improvements, productivity enhancements, greater employment rates, etc.; and

[20] For example, if a given regulation increases the cost of energy production, this will be reflected in the cost structure of a number of industries, which might then pass-on part of this additional cost downstream along the value chain and eventually to end consumers. Similarly, if a certain regulation on the safety of chemical substances entails the withdrawal of certain products, downstream users will have to face replacement costs.

- O*ther non-monetizable benefits*, such as protection of fundamental rights, social cohesion, international and national stability, etc.

- ***Area 6 contains a list of "ultimate impacts" of regulation***, which overlap with the ultimate goals of regulatory intervention: even if some regulations directly aim at achieving these benefits (in which case, we would include them in Area 4), normally all regulations aim, as an ultimate impact at achieving some advancement in social welfare, which can be described in terms of efficiency or in others terms: these ultimate impacts encompass well-being, happiness and life satisfaction, environmental quality, and more economic goals such as GDP growth and employment. This area lies at the intersection between regulatory impacts and regulatory goals. It is important to highlight it in a visual representation of regulatory impacts for at least two main reasons. First, while the first applications of cost-benefit analysis to legal rules (as in the US RIA system) chiefly looked at efficiency and thus at the calculation of net benefits for the justification of action in regulation, many governments today adopt a wider variety of regulatory goals when regulating, which leads to the measurement of distributional effects and, more generally, at more subjective outcomes such as life satisfaction. Second, a number of methods are being developed to track directly the ultimate impact of a given future state of the world (e.g. life satisfaction), rather than developing the analysis from the comparison of costs and benefits. These approaches (often termed "measurement of subjective well-being", or "happiness metrics") try to avoid some of the methodological shortcomings of neoclassical cost-benefit analysis to measure: among others, an important feature of these methods is that instead of relying on income as a proxy of happiness, they try to measure the latter directly[21]. The availability of broadband for all citizens, for example, can generate impacts in terms of life satisfaction, due to the elimination of administrative burdens and to enhanced possibility of communication. The transition towards tele-work is another good example, as it leads to enhanced possibilities for those wishing to enjoy family life and reconcile it with working duties.

2.2.2 Monetizing non-market impacts

One of the key challenges in RIA is the quantification and monetization of benefits, especially when these benefits are related to non-market goods such as health, safety and the environment. Economists have engaged into a never-ending debate on the viability of methods that are aimed at attaching a monetary value to these benefits: some critics argue that attempting to attach a monetary value to impacts such as saved human lives or lost biodiversity amounts to "knowing the price of everything, and the value of nothing"[22].

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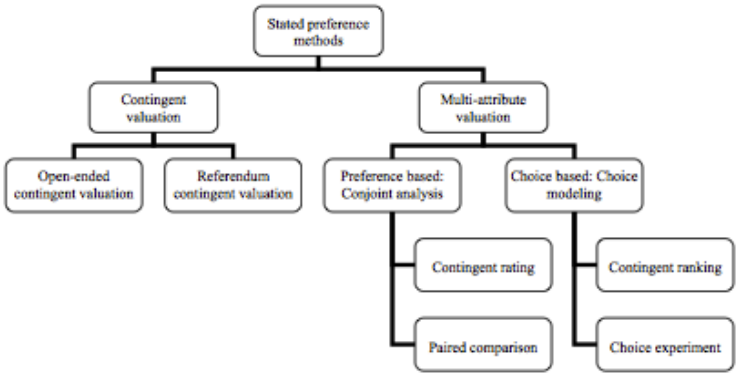
[21] See Renda, A. (2011), *Law and Economics in the RIA World*, Intersentia, Amsterdam. And see also Daniel Fujiwara and Ross Campbell (2011), Valuation Techniques for Social Cost-Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches. A Discussion of the Current Issues, Report for the UK government. Available online at the following website: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209107/greenbook_valuationtechniques.pdf.

[22] F. Ackerman and L. Heinzerling, *Priceless: on Knowing the Price of Everything and the Value of Nothing*, New York: The New Press, 2004.

There are two main methods used by economists to monetize benefits that are not subject to market exchange. Both are essentially based on the concept of "willingness to pay" (WTP):

- ***Revealed preference*** methods are based on the assumption that people's behavior, when spontaneous, is the best possible indication of the preference of individuals. For example, the extent to which some consumers are willing to pay for higher broadband speeds reveals their associated willingness to pay.
- ***Stated preference methods*** are used when it is impossible to infer individuals' WTP from an observed behavior or by means of any revealed preference method. These models imply that individuals surveyed state their WTP (or willingness to accept compensation, WTA) for a given change in policy, or a related impact. Inevitably, the accuracy of these estimates depend on the ability of the analyst in designing the survey and framing the context in which surveyed individuals will respond to their questions. Figure 5 below shows the most common variants of the stated preference models.

Figure 5 – Families of stated preference methods



Source: Merino-Castello (2003).

In summary, in mainstream economic theory, benefits are calculated as the sum of the WTPs of all individuals involved by a given policy change. To the extent that this calculation is possible, economists have the possibility of expressing all benefits with a common unit of measurement, *i.e.* money. WTP is a very powerful measurement instrument in cost-benefit analysis. For example, it can measure the maximum amount of money an individual would be willing to pay to improve its or others' health, to avoid getting hurt, to obtain an environmental improvement or to preserve natural resources, etc. Accordingly, the WTP concept is often used to estimate impacts that are otherwise impossible to measure, such as the preservation of biodiversity: asking people what they would be willing to pay to preserve the environment should give a first-blush assessment of what this is worth to citizens today.

However, many economists doubt that WTP can always be a good proxy for the assessment of benefits. The main reasons can be quickly summarized as follows:

- Income is not a good proxy for utility and happiness;
- It is rather the "ability to pay", not the "willingness to pay", that dictates market choices: people face income constraints that cost benefit analysis often neglects;

- People's happiness depends also on what other individuals are endowed with;
- People sometimes tends to underrate the value of long-term impacts, especially if they are weighed against shorter term ones, due to a lack of inter-generational altruism or simple shortsightedness;
- People make mistakes for what concerns their WTP (due to both bounded rationality and rational ignorance)[23];
- People make mistakes for what concerns the real value associated with their actions;
- People value differently gains and losses due to the "endowment effect" [24].

2.2.3 Reconciling RIA with long-term policy goals

As already illustrated in the previous sections, it is important to recall that the original US RIA model is mostly geared towards ensuring that government agencies take "efficient" decisions, *i.e.,* decisions that maximize net benefits for society as a whole. This means that RIAs produced by Federal agencies will tend towards the ultimate goal of maximizing total welfare. This assumption, as recalled above, only holds if one believes *i.a.* that WTP can be taken as a proxy of people's preferences, wealth can be taken as a proxy for welfare, and income does not exhibit decreasing marginal returns. If one does not, then adopting efficiency as the "litmus test" for adopting legislation might be ill-advised; RIA could still count on CBA, but the results of CBA would only provide a technical input to, and by no means a constraint to, the ultimate political decision to be adopted.

Even beyond the methodological problems of CBA, there may well be cases in which RIA is made functional to objectives other than efficiency. For example, South American countries such as Brazil and Ecuador have specifically launched long-term policy strategies aimed at "quality of life" (*Buen Vivir*), which includes distributional issues such as the eradication of extreme poverty and the reduction of inequalities. The European Union has in 2010 launched a new long-.term strategy, termed Europe2020, which includes five headline targets and associated indicators[25]. In all these cases, governments might want to reconcile the methods and criteria applied in their RIA documents with the targets they have given themselves for the medium-long term: alternative policy options might then be compared not only, and not mostly, based on the net benefits they generate, but rather in terms of their ability to meet the government long-term targets. In this respect, RIA can

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[23] Rational ignorance refers to the fact that rational individuals do not find it convenient to acquire all possible information on a future course of action, due to excessive cost of information collection compared to the marginal benefit of acquiring an additional piece of information. Bounded rationality, to the contrary, refers to the fact that people make systematic mistakes that lead them to deviate from a rational course of action.

[24] This last critique has led economists to focus also on another proxy for the intensity of individual preferences, i.e. WTA. WTA compensation is the minimum amount of money an individual is willing to accept for not receiving a given improvement, or for being deprived of resources or assets they used to possess before. Part of the literature uses also the terms "equivalent variation" and "compensating variation" to denote the value underlying the concepts of WTP and WTA. See, also, the UK Green Book on evaluation, Section 2.1., at http://www.hm-treasury.gov.uk/d/green_book_valuationtechniques_250711.pdf.

[25] http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm.

become functional to **greater policy coherence** in government, in addition to the efficiency of public policymaking.

3 Using RIA to make better decisions in the ICT sector

RIA can be a useful support to the quality of policymaking in the ICT sector, and in particular in the policy fields that are most often subject to regulation. Compared to other sectors, ICT policy has been less exposed to the debate on RIA, mostly since in many countries ICT policy is dealt with by regulatory authorities that are independent of government, which means that RIA is not an obligation for telecom regulators. At the same time, the legal status of many agencies in the sector, the highly specialized technical and economic aspect of many of the regulations adopted and the fact that stakeholder consultation is widespread in the sector are factors that make RIA even more potentially useful as a tool that facilitates the dialogue between public authorities and stakeholders, and increase the quality of the debate as well as the quality of the rules enacted.

Against this background, regulators such as FCC in the US, Ofcom in the UK and AGCOM in Italy have adopted own methodologies to carry out RIA of major regulatory decisions. In countries like Jordan and Qatar the telecommunications regulators perform RIA in support of major regulatory decisions. However, in many countries around the world the potential of RIA has not been fully exploited. Below is presented a selection of national experiences with RIA in the ICT sector.

3.1 National experiences with RIA in the ICT sector

Some regulators around the world make regular use of RIA or cost-benefit analysis when adopting their regulatory decisions. For example:

In the **United States** the Federal Communications Commission (FCC), as a non-governmental agency, is not obliged to perform RIA on its major regulations; however, in order to justify its approach to the policy problems it faces it has shown increasing willingness to do cost-benefit analyses. A recent Report of the Administrative Conference of the United States noticed that it is now understood at FCC that cost-benefit analysis is "an expected part of the agency's decision making," and that when the Office of the General Counsel reviews rules for compliance with the Administrative Procedure Act and other statutes, they now look to see that the rule contains evidence of having considered costs and benefits[26]. The surveyed officials said FCC does not just do cost-benefit analyses for "major" rules, but instead views it as a "sliding scale" in which the more important rules generally get more analysis than less important ones. In this respect, the approach is similar to the "principle of proportionate analysis" adopted by the European Commission[27].

[26] See Copeland in http://www.acus.gov/sites/default/files/documents/Copeland%20Final%20BCA%20Report%204-30-13.pdf ; and also http://www.acus.gov/sites/default/files/documents/Indep%20Agency%20BCAs%20Draft%20Rec%20Final%202-15-2013.pdf , and http://www.techpolicyinstitute.org/news/show/23594.html

[27] See above, note 24.

In the **UK**, Ofcom has since 2005 issued a document stating its own approach to RIA[28]. The document explains the importance of carrying out RIA of policy decisions, with emphasis on the need to consider the "do nothing" option before acting as a regulator. Moreover, Ofcom's document contains a checklist to be followed in RIA in the telecommunications and media field.

In the European Union, **the European Commission** has performed several RIAs on issues related to ICT policy. In particular, the Directorate General for the Information Society (DG INFOS; now re-named DG CONNECT) has carried out RIAs on 39 proposed policy initiatives between 2003 and May 2014. In addition, during the same period the Directorate General for Research and Innovation performed 24 RIAs on issued that are often tightly related to ICT. This is by far the largest number of RIAs in the field of ICT that can be found worldwide today: for each of these RIAs, the European Commission has sought the identification and assessment of economic, social and environmental impacts of a range of alterative policy options, and almost always coupled the proposals with extensive consultation of stakeholders (at least twelve weeks).

In Canada, some of the RIAs performed by the federal government have affected the ICT world. For example, the new Electronic Commerce Protection Regulations were subject to a RIA in 2013, for the purpose of effectively implementing the Canadian Anti-spam legislation[29].

In Colombia, a comprehensive ex post evaluation of the overall impact of the regulatory framework for telecommunications has been performed on an annual basis with the support of external consultants[30]. The reports issued cover a five-year period and evaluate the impact of major regulatory measures adopted during the selected period, with the use of econometric techniques.

Below, some examples of RIAs carried out in the ICT sector are illustrated in detail.

3.2 Examples

3.2.1 The RIA on the EU Roaming Regulation

The regulation of wholesale roaming tariffs is a very ambitious project of the European Union, which saw the light in 2007, with the first regulation that set a cap on both wholesale and retail tariffs applied by mobile operators in EU27. With the "roaming regulation", European citizens are much less exposed to outrageous mobile phone bills when travelling to another Member State of the European Union. The related RIA contained a sophisticated cost-benefit analysis, which also incorporated a sensitivity analysis, *i.e.* the European Commission used three possible measures of demand elasticity

[28] http://stakeholders.ofcom.org.uk/binaries/consultations/better-policy-making/Better_Policy_Making.pdf

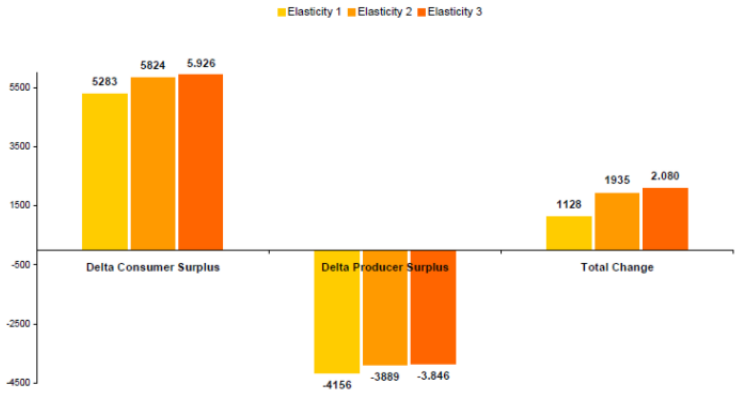
[29] "Act to promote the efficiency and adaptability of the Canadian economy by regulating certain activities that discourage reliance on electronic means of carrying out commercial activities, and to amend the Canadian Radio-television and Telecommunications Commission Act, the Competition Act, the Personal Information Protection and Electronic Documents Act and the Telecommunications Act ("Canada's Anti-spam Legislation" or "CASL"). See the impact assessment at http://fightspam.gc.ca/eic/site/030.nsf/eng/00271.html#fnb1.

[30] See *e.g.,*(CMT (2007), Impacto del marco regulatorio en su conjunto, en relación con la sostenibilidad, viabilidad y dinámica del sector de las telecomunicaciones. Cuarto informe Parte I Econometría S.A., julio de 2007, available at www.crcom.gov.co.

to calculate what the reaction of end users to lower roaming tariffs would be. As a matter of fact, the Commission eventually applied a Kaldor-Hicks cost-benefit analysis and justified the adoption of a double layer of regulation – at the wholesale and retail level – by showing that net benefits would be maximized under that option compared to all alternatives.

The Commission considered various policy options, from the *status quo* option to the adoption of the European Home Market Approach, Commissioner Reding's initial preferred option, the regulation at wholesale level only, and the finally retained option (regulation at wholesale and retail level). Figure 6 below reports graphically the Commission's conclusions for the retained policy options.

Figure 6 – net benefits of retail and wholesale capping (Billion Euros)



Source: Commission Impact Assessment, SEC (2006) 925, 12 July 2006

This properly done RIA, however, hides a specific problem, in that the description of "net benefits" portrayed by the European Commission was ignoring distributional effects. As a matter of fact, in Europe only 147 million users out of approximately 450 million European citizens were involved in the roaming market in 2006; 75% of those users (110 million) were business customers, whose bill was most likely paid by their employers; and the remaining 25% were mostly frequent leisure travelers and relatively wealthy consumers. The Commission acknowledged that "with many customers rarely or never consuming roaming services (66% of all mobile customers never roam according to A.T. Kearney), the welfare gains of high-frequency roamers would be substantial, as they would be able to reap the overwhelming part of the resulting changes in consumer surplus... Other things being equal, it is to be expected that business customers who currently are not on large-scale competitive contracts (as would be the case for most SMEs), high-frequency leisure travelers and people living in border regions would profit most from a reduction in roaming charges"[31].

Looking at the results of the cost-benefit analysis, is the redistribution of income from firms to consumers going to be neutral from the standpoint of social welfare? And, even more importantly, are we sure that the change in consumer surplus does not hide income transfers between

[31] Commission staff working paper - Impact assessment of policy options in relation to a commission proposal for a Regulation of the European Parliament and of the Council on roaming on public mobile networks within the community {COM(2006) 382 final} {SEC(2006) 926} /* SEC/2006/0925 */, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2006:0925:FIN:EN:HTML

consumers? The Commission seems to acknowledge this possibility in the RIA: *"To the extent that overall revenues of the mobile industry would come down as a result of regulation under some of the policy options, and to the extent that the revenue streams affected would be particularly high-margin ones, other things being equal it is reasonable to assume* some *reduction of investment …… It is reasonable to assume that while at the margin some rebalancing of tariffs will occur, a general increase in the price level for other services, given intense competition in major markets, is highly unlikely"*[32]. Accordingly, it is fair to state that, while drafting the RIA document, the Commission was aware of the following facts: (i) that the mobile sector was highly competitive; (ii) that regulating roaming would create some reduction of investment in this highly dynamic sector – a key sector for the competitiveness of the EU economy; and (iii) that even some rebalancing of tariffs, with a potential increase of domestic retail tariffs, could occur, but the intense competition between mobile operators would have kept such increase at a minimum. However, this consideration did not change the Commission's final decision as to which policy option was to be preferred.

In this specific case, the European Commission did not take distributional issues into due account when crafting future policy interventions: and by providing a cost-benefit analysis which looks merely at a static vision of the "size of the pie" to judge whether a policy proposal must be considered preferable to alternatives, or not. Interestingly, the consultation run by the European Commission a few years after the enactment of the 2007 Roaming regulation led to a finding that was in line with the waterbed effect: operators were relying on revenues from retail SMS tariffs to partly compensate the lost revenues in voice.

After the implementation of the regulation, the European Commission has been monitoring developments in the roaming market carefully and in its Interim Report on the functioning of the Regulation, published June 2010, noted that competition was not strong enough. Another RIA performed in 2011 led to the decision to further lower wholesale and retail roaming tariffs. Finally, in 2013 the European Commission has proposed the abolition of roaming charges as of 2015, a proposal that has been endorsed by the European Parliament and awaits the final decision of the Council of the EU later this year. In the associated impact assessment (which considers a much broader set of actions, including the elimination of international roaming charges) the Commission calculates the losses that would accrue to the wireless sector, but then observes that given the (likely) high elasticity of demand, some of these losses would be mitigated by greater volumes of traffic, and accordingly higher revenues[33].

3.2.2 The Australian RIS on lot design for clearing the digital dividend

In April 2013, the Australian Communications and Media Authority (ACMA) ran the so-called "digital dividend" auction, aimed at reallocating two bands of spectrum (700 MHz and 2.5 GHz). The allocation instruments to be designed included an allocation determination and two marketing plans (one for each band) under section 39A of the Act, that specify, amongst other things, how the

[32] Commission Staff Working Paper, Impact Assessment of policy options in relation to the commission's review of the functioning of Regulation (EC) no 544/2009 of the European Parliament and of the Council of 18 June 2009 on roaming on public mobile telephone networks within the community, available at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011SC0870&from=EN.

[33] See the impact assessment on the proposal for a Connected Continent, SWD (2013) 331, at http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2013/swd_2013_0331_en.pdf

spectrum will be configured into lots for sale at auction. This is known as 'lot configuration'. A Regulatory Impact Statement was produced in support of this crucial decision.[34] The primary problem being addressed by ACMA in this RIA was how to configure the spectrum so as to promote its efficient allocation and use. In addressing this problem, the ACMA tried to ensure that the lot configuration would not limit or dictate market outcomes or hinder competition between auction participants. ACMA also had to consider the likely future uses of digital dividend spectrum.

ACMA identified three options for the configuration of the frequency bandwidth, namely 2x5 MHz lots, 2x10 MHz lots, and 2x15 MHz. Five options for configuring the geographic area were examined, ranging from national market area lots to disaggregated metropolitan, regional and remote market area lots. In considering the optimum lot configuration, ACMA took into account a wide range of technical, commercial and policy factors that were likely to affect the overall benefit to the community derived from reallocating the spectrum. In terms of lot configuration, a minimum frequency bandwidth of 2x5 MHz lots appeared to be ideal because it is consistent with international standards for LTE, and can be aggregated into 2x20 MHz licenses, which allows maximum spectral efficiency. It also allows the two bandwidths to be divided into equally sized lots, and promotes competition in the auction.

Generally speaking, geographic disaggregation was found to minimize the risk that spectrum in any single geographic region would lie idle. However, increased disaggregation also increases the chances that there may be utility loss zones in which no services can be provided. This occurs when different parties own spectrum licenses that share a boundary. Due to the propagation characteristics of the two bands, spectrum utility loss zones are likely to be far larger for the 700 MHz band than the 2.5 GHz band. Furthermore, the propagation characteristics of spectrum in the 2.5 GHz band lends itself to providing capacity in densely populated areas, while the 700 MHz band can be used to transmit signals over greater distances. This suggests that there would be benefit in geographic disaggregation for the 2.5 GHz band, while the 700 MHz band is better suited to providing national coverage.

ACMA undertook extensive public consultation on the issue of lot configuration, and has received a broad range of feedback from stakeholders. The majority of stakeholders preferred a national market area in the 700 MHz band, stating that the propagation characteristics of the spectrum allow for service coverage over large geographic areas. They also favored a national area because it accommodates the layout of a national mobile network. They favored minimum frequency lots of 2x5 MHz, stating that frequency lots smaller than this were inappropriate for the operation of either 3G or 4G technologies. Stakeholder views differed on the preferred lot configuration for the 2.5 GHz band. Some stakeholders expressed a preference for national lots, and others for disaggregated lots. There were also mixed views as to the most appropriate frequency bandwidth for the lots.

The options were compared through a multi-criteria analysis, which aimed at assessing the consistency of the various options with the technical characteristics of the band, as well as possible costs.

[34] http://ris.dpmc.gov.au/files/2013/01/03-Lot-configuration-RIS.pdf

Table 1 – Assessment of options for the Australian Digital Dividend Lot Configuration RIA

No	Option	Benefits		Costs	
		Fit with potential bidders' business plans	Subsequent allocations	Complexity	Technical inefficiencies
1	National lots (1 lot)	✓	✓	X	X
2	Aggregated metro and regional lots (2 lots)	✓	✓	X	X
3	Metropolitan regional and remote lots (11 lots)	✓✓✓	✓✓	XX	XX
4	State/territory based lots (8 lots)	✓✓	✓✓	XX	XX
5	Metro, regional and remote lots further disaggregated (15 lots)	✓✓✓	✓✓	XXX	XXX

Source: ACMA (2013), table 2

In addition, the possible bandwidth configuration within each plan was discussed: the three main options available (5MHz, 10MHz and 15MHz) are compared in table 3 below. As shown in the table, the criteria chosen for comparison are not in line with standard cost-benefit analysis, but are rather used to ensure the technical feasibility and the consistency of the configuration with specific policy goals, such as the promotion of competition in the auction and in related markets for services.

Table 2 – bandwidth configuration within each band

	2x5 MHz	2x10 MHz	2x15 MHz
700 MHz			
Consistent with the technical characteristics of the likely uses of the band?	✓✓✓	✓✓	✓✓
Do the lots sum equally to the total quantity of spectrum available?	✓✓✓	X	✓✓✓
Promotion of competition in the auction and in related markets for services?	✓✓✓	✓✓	✓
2.5 GHz			
Consistent with the technical characteristics of the likely uses of the band?	✓✓✓	✓✓	✓✓
Do the lots sum equally to the total quantity of spectrum available?	✓✓✓	✓✓✓	X
Promotion of competition in the auction and in related markets for services?	✓✓✓	✓✓	✓

Source: ACMA (2013), Table 3

The recommended options for the lot configuration in the 700 MHz and 2.5 GHz band were the following:

- A national geographic market for the 700 Mhz band and minimum frequency bandwidth of 2x5Mhz lots, which is expected to facilitate a competitive bidding environment, as the CCA will

provide bidders with the flexibility to package together lots to meet their specific spectrum requirements.

- Disaggregated metropolitan, regional and remote market areas for the 2.5 GHz band, including eight metropolitan areas, two regional areas and one remote area, with recommended frequency bandwidth of 2x5 MHz lots.

The combination of the regulatory impact analysis with the consultation of stakeholders ensured that this decision was fully shared with the market operators and oriented towards efficient outcomes.

The auction finally took place in May 2013 and three operators secured portions of spectrum in both bands[35].

3.2.3 Qatar's RIA on the Quality of Service for telecommunications

On March 6, 2014 the Communications Regulatory Authority (CRA) of Qatar issued two draft documents which aim at better regulating QoS in Qatar[36]:

1. A QoS Policy which sets out the basis upon which the QoS offered by Service Providers will be measured and regulated by CRA. Its goal is to set policies, objectives and general principles to regulate QoS in Qatar.
2. A QoS Regulatory Framework which sets how CRA is going to regulate QoS offered by Service Providers. Its goal is to define Key Performance Indicators (KPIs), targets, measurements methods, reporting and publication procedures, validation and audit approaches and enforcement procedures.

These two documents, once adopted, are expected to significantly impact the telecommunications market in Qatar. As a consequence, CRA published a consultation document which includes a RIA (termed "Impact Assessment".

The main objective of the Qatari RIA is the analysis of the likely effect of the different regulatory options for each type of stakeholder. The policy options considered are the following:

Option 1. *Change nothing*. Under this option QoS is regulated as it is now .i.e with KPIs and targets listed in Service Providers' licenses around) 30 for fixed services and 6 for mobile services). Fines can be applied in theory in case targets are not met. However, they do not apply in practice.

Option 2. CRA's proposed option in the QoS Regulatory Framework whereby Service Providers must measure KPIs, must report the results of the measures and must meet imposed targets (if not, Service Providers have to pay defined penalties through Performance Bonds or compensate end-users).

Option 3. Similar to option 2, but Service Providers are not financially penalized when targets are not met. In practice, this approach is in fact the same as option 1 because in practice, in

[35] See http://www.acma.gov.au/Industry/Spectrum/Digital-Dividend-700MHz-and-25Gz-Auction/Reallocation/digital-dividend-auction-results.

[36] See http://www.ictqatar.qa/en/documents/download/Annex%204%20-%20QoS%20impact%20assessement.pdf.

the current situation, no penalties are applied. The only difference is the list of KPIs considered.

Option 4. "Remove all QoS atar, requirements". However, given the low level of competition in Q this option is not considered as a realistic option for CRA and will therefore not be .considered in the rest of the document

Depending on the type of option undertaken, three types of costs might be incurred by Service Providers: the cost of measuring KPIs; the cost of reporting results of the measurements; and the cost of making improvements in their network to meet established targets or paying penalties if targets are not met. The CRA also calculates its own costs related to the monitoring of the future regulatory obligations. In light of the results of the RIA, CRA concludes that the estimated benefits expected from the QoS Regulatory Framework largely outweigh the estimated costs which should represent less than 5% of existing Service Provider revenues in the very worst case scenario (70% of targets not met, while CRA believes many of the targets being imposed would be met today). Option 3 is similar to Option 2, but would not provide sufficient incentives for Service Providers to improve QoS levels given the absence of penalties. The new QoS Regulatory Framework should increase QoS provided in Qatar but also provide much better information on QoS to end-users and therefore fill the gap between expected QoS and experienced QoS. This would also increase competition between Service Providers and provide Qatar with telecommunications infrastructure of very high standards. Table 4 below summarizes the impact on stakeholders as shown by the CRA.

The consultation closed on April 20, 2014. The results are being reviewed and will be incorporated in the elaboration of the final regulation, which is due later this year. The use of a preliminary impact assessment and extensive consultation ensure that the final decision to be adopted will be shared with the market operators: this also suggests that impact assessment, when coupled with consultation, ca increase the perceived legitimacy and quality of the rules that are being introduced by the regulator.

Table 3 – Costs and benefits of the proposed QoS regulatory framework in Qatar

	Option 1 – Change nothing		Option 2 – CRA's proposed approach		Option 3 – CRA's proposed approach without enforcement procedure when targets are not met	
	Estimated costs	Estimated benefits	Estimated costs	Estimated benefits	Estimated costs	Estimated benefits
Service Providers	No additional cost but bad understanding of QoS delivered to end-users and bad ability to compete	-	Minimum: QAR 2,810,000 if Service Providers' network is at a level which is in line with requested targets Maximum: QAR 82,400,000 if Service Providers' network requires improvements	Better understanding of QoS delivered to end-users Higher usage, i.e. higher revenues	Between QAR 2,810,000 and QAR 6,810,000	Better understanding of QoS delivered to end-users
CRA	No additional cost but objectives not achieved	-	Between QAR 2,420,000 and QAR 10,780,000 per annum depending on the number of independent studies needed	CRA's statutory objectives will be achieved	Between QAR 2,420,000 and QAR 10,780,000 per annum depending on the number of independent studies	CRA's objectives to increase investment and benefits to customers will not be fully achieved
End-users	Risk of insufficient level of QoS experienced Difficulty to assess QoS and to compare Service Providers	No risk of increase in prices	Between QAR 2,810,000 and QAR 82,400,000 per annum only if Service Providers pass on to customers cost increases. In this case, Service Providers impact must be reduced accordingly Otherwise 0.	Higher QoS or compensation if targets not met Better information to select a Service Provider Better information to understand areas where QoS is not good	Between QAR 2,810,000 and QAR 6,810,000 per annum only if Service Providers pass on to customers cost increases. In this case, Service Providers impact must be reduced accordingly Otherwise 0.	Better information to select a Service Provider Better information to understand areas where QoS is not good

Source: CRA, Impact Assessment in Relation to the Quality of Service Regulatory Framework, Consultation document, 6 March 2014, Annex 4, http://www.ictqatar.qa/en/documents/download/Annex%204%20-%20QoS%20impact%20assessement.pdf

3.3 Concluding remarks

This section has shown that RIA can be a very useful took for ICT regulators wishing to adopt new rules that will have a significant impact on the market. The examples we have reported also show that RIA can help regulators in at least three ways:

- By enabling a more structured reflection on the available alternatives (e.g. in the EU Roaming Regulation case, the initial alternative turned out being inefficient, and was later discarded);
- By facilitating the debate between the regulator and stakeholder in the definition of the content of the rules to be adopted (e.g. in the case of Qatar, an earlier consultation had already been launched in 2013 to shape the main regulatory alternatives at stake);
- By increasing the perceived and actual legitimacy and quality of the final rules (e.g. the Australian digital dividend example led operators to gather full knowledge of why frequencies had been divided in 5Mhz lots, and why geographical areas had been selected in a different way between the 700 MHz and 2.5Ghz bands).

4 Introducing RIA in the ICT sector: a checklist for ICT regulators

4.1 Introducing RIA in the ICT sector

Based on what as discussed in the previous sections, in order to introduce successfully the RIA toolkit in the regulatory process of ICT regulators, the following elements have to be present:

- **A "holistic" approach to smart regulation**, which couples the use of RIA with the use of consultation, interim monitoring and ex post evaluation.
- **Appropriate governance arrangements (in particular, transparency)**: in the case of independent ICT regulators, independent scrutiny of RIA documents by an external oversight body may not be needed, provided that draft RIAs are subject to a sufficiently long consultation period and the ICT regulator motivates explicitly why certain comments submitted during the consultation were not taken into consideration in finalizing the proposal.
- **Building sufficient regulatory capacity in administrations.** Regulators in the ICT sector often have sufficient capacity to assess the impacts of proposed regulations; however, RIA requires a specific mindset, especially for what concerns the analysis of all direct and indirect impacts, as well as the analysis of the long-term impacts of policy decisions.
- **Sustained focus and political commitment**. Lack of momentum and sustained political commitment can kill regulatory reform in all sectors, including ICT. It is therefore important that ICT regulators confirm their commitment towards transparency and accountability through the regular use of tools such as RIA, consultation and ex post evaluation. Expectations should not be raised too high or too early, since the implementation of RIA might take time.

4.2 A checklist on how to perform individual RIAs

Below is a straightforward checklist to be followed by ICT regulators when approaching a RIA. The checklist is composed of the following questions (click on hyperlinks to go directly to the question).

Box 2: Summary regulatory checklist for RIA	
Question 1.	**What is the policy problem, if any?**
Question 2.	**Is the policy problem a market failure or a regulatory failure?**
Question 3.	**What are the main drivers of the policy problem?**
Question 4.	**Who is affected by the current situation?**
Question 5.	**What might happen if no policy action is undertaken?**
Question 6.	**What would happen under the "zero option"?**
Question 7.	**What alternatives would possibly address and solve the policy problem?**
Question 8.	**What direct costs are likely to be generated by the available alternatives?**
Question 9.	**What are the direct benefits expected from the various alternatives?**
Question 10.	**What are the likely indirect impacts of available alternatives?**
Question 11.	**What is the most appropriate criterion for comparing alternatives?**
Question 12.	**What are the major risks? Sensitivity analysis**
Question 13.	**How will the regulation be monitored and evaluated?**

Question 1. What is the policy problem, if any?

Regulators in the ICT sector typically face a set of recurrent policy problems. It is important that the problem is classified as a market failure or a regulatory failure, and the main drivers of the problem are accurately highlighted. ***Example: limited market competition is leading to too high prices and/or limited incentives to innovate or invest in new products.***

Question 2. Is the policy problem a market failure or a regulatory failure?

- A market failure (if yes, specify which type); - ***example: monopoly power***
- A regulatory failure, (if yes, specify which type) – ***example: insufficient copyright enforcement***

Question 3. What are the main drivers of the policy problem?

Example: very high market concentration is due to high barriers to entry, including very restrictive licensing conditions for market entry.

Question 4. Who is affected by the current situation?

Example: end consumers; investors; existing operators; potential new entrants.

Question 5. What might happen if no policy action is undertaken?

Example: consumers will be negatively affected since they will get higher prices and limited innovation/dynamic efficiency.(little incentives for operators to invest in network upgrades?)

Question 6. What would happen under the "zero option"?

You must remember to always include the "zero" option in the list of regulatory alternatives. The zero option corresponds to the baseline scenario: this means that it is not limited to a description of the status quo, but it incorporates a more forward-looking view of how the current situation would change absent regulatory intervention. In the ICT field, a typical question regulators should ask themselves is whether technology alone could solve the problem over time. For example, fixed-mobile substitution could partly solve the problem of limited consumer choice in the fixed-line market; enhanced use of Digital Rights Management has been considered as having the potential to partly solve the problem of online copyright infringement; the development of wireless broadband platforms powered by operating systems such as Apple iOS or Google Android is increasing the variety of competing products, for example in VoIP (*e.g.,* Skype) or in instant messaging as an alternative to SMS (e.g. Whatsapp); finally, new technologies such as cognitive radio and mesh networks might solve the problem of scarcity (or sub-optimal use) of spectrum in the coming years.

Moreover, ICT markets often feature a breath-taking pace of change and the emergence of a particular kind of competition – what sometimes economists refer to as "Shumpeterian" competition. When this is the case, markets tend to be dominated by a one-generation leaders, which appear unbeatable but end up being quickly replaced by new market leaders. The combination of network externalities and technological advancements has led to the rise and fall of many leading businesses in the ICT ecosystem, from Lotus 123 to Altavista, Myspace, and to some extent even Microsoft Windows or Internet Explorer. A good understanding of the dynamics of ICT markets is therefore essential for ICT regulators, which should refrain from interfering with the ongoing process of "creative destruction" that characterizes many ICT markets.

In summary, regulators have to be aware of the constantly changing technological environment if they want to avoid making mistakes in their regulations. RIA provides the perfect platform for this reflection, especially if the regulator decides to consult stakeholders also on the relevance of technological development for the problem at hand.

Question 7. What alternatives would possibly address and solve the policy problem?

Alternative policy options can be identified by looking at a sliding scale that goes from the least restrictive form of intervention to the most heavy handed. Examples of alternatives that might be kept in mind by ICT regulators are the following:

- **Awareness-raising campaigns** are typically cheap to implement, but their effectiveness is often very partial. Simply increasing the amount of information available to end users does not mean that the latter will change their behavior. For example, a few years ago some governments tried to address the problem of online piracy by mandating that all movie theaters showed a video clip of a few minutes before projecting the movie, in which the criminal nature of copyright infringement through online piracy was explained in detail. The overall impact of the campaign was, however, very limited.
- **Self- and co-regulation** are often potential regulatory alternatives in the ICT ecosystem. This is due to the fact that the complexity and the very fast-changing nature of the ICT environment

often call for a joint intervention of the public authorities and the private players. For example, recent laws on net neutrality and on copyright infringement mandate that ISPs act as controllers of the behavior of their subscribers. Online advertising, child protection and privacy are still subject to a combination of general legislation and private standards in many parts of the world. The Internet itself, through ICANN and IETF, is subject mostly to private regulation. Table 5 below shows Chris Marsden's "Beaufort scale" of the many hybrids that exist in the ICT ecosystem between pure self- and full-fledged co-regulation. As mentioned also in Cafaggi and Renda (2012), regulators could find it useful to break down the phases of the regulatory intervention (e.g. into agenda-setting, standard-setting, implementing acts, monitoring and evaluation, enforcement) and decide which phases would be more effectively dealt with by private actors, as opposed to others that should remain within the remit of public authorities.

Table 4 – Marsden's "Beaufort scale" of self- and co-regulation[37]

Scale	Regulatory scheme	Self–Co	Government involvement
0	'Pure' unenforced self-regulation	SecondLife	Informal interchange only – evolving partial industry forum building on players' own terms
1	Acknowledged self-regulation	ATVOD	Discussion, but no formal recognition/approval
2	*Post-facto* standardised self-regulation	W3C#	Later approval of standards
3	Standardised self-regulation	IETF	Formal approval of standards
4	Discussed self-regulation	IMCB	Prior principled informal discussion, but no sanction/approval/process audit
5	Recognised self-regulation	ISPA	Recognition of body – informal policy role
6	Co-founded self-regulation	FOSI#	Prior negotiation of body – no outcome role
7	Sanctioned self-regulation	PEGI# Euro mobile	Recognition of body – formal policy role (contact committee/process)
8	Approved self-regulation	Hotline#	Prior principled less formal discussion with government –with recognition/approval
9	Approved compulsory co-regulation	KJM# ICANN	Prior principled discussion with government – with sanction/approval/process audit
10	Scrutinised co-regulation	NICAM#	As 9, with annual budget/process approval
11	Independent body (with stakeholder forum)	ICSTIS#	Government imposed and co-regulated with taxation/compulsory levy

Note: # denotes 'soft power' of government/EC funding.

Source: Chris Marsden.

[37] ATVOD is the Authority for Television On Demand; W3C is the World-Wide-Web consortium; IETF standard for Internet Engineering Task Force; IMCB is the Internet Mobile Classification Board; ISPA is the Internet Service Providers Association; FOSI is the Family Online Safety Institute, whereas PEGI stands for Pan European game Information. KJM is the German Commission for youth protection on the media. ICANN is the Internet Corporation for Assigned Names and Numbering. NICAM is the Netherlands Institute for the Classification of Audio-visual Media. Finally, ICSTIS stands for Independent Committee for the Supervision of Standards of the Telephone Information Service (no renamed PhonepayPlus).

- **Transparency requirements** are often very useful for end users, especially when the policy problem (or one of its drivers) is partly due to an informational asymmetry between the service provider and the end user; when this is the case, however, the behavioral consequences of providing more information to end users have to be carefully taken into account. For example, in 2009 the EU Directive on Universal Service Obligations in electronic communications was amended to introduce a new rule (Article 20), which mandated that Internet Service Providers had to provide information to their subscribers as regards traffic management or blocking/throttling practices they engaged into on their networks. However, no mention was made of the way in which this information had to be provided: this significantly weakened the impact of the provision, since absent a standardized, user-friendly way to convey this information to the non-specialized end users, there was no guarantee that users would fully understand the meaning and consequences of these technical practices.
- **Use of market-based mechanisms**. Market-based mechanisms encompass a family of potential ways to let the market reallocate property rights. For example, the facilitation of secondary trading for spectrum has been advocated by academics since Ronald Coase (1959) and has been subject to several applications around the world. The use of auctions to reallocate rights, especially in spectrum policy, is now a consolidated practice that is being significantly improved with innovative auction designs (think about "incentive auctions" in the US). The international experience and the law and economics literature so far suggest that whenever transaction costs are not prohibitively high, regulators should consider adopting rules that facilitate market exchange between operators, in order to delegate the decision on the most efficient distribution of rights to market forces. However, the role of hold-up behavior, strategic conduct and exercise of market power should not be underestimated: for example, in the case of spectrum trading it is fair to state that most often powerful players would tend to hoard spectrum and not release it in favor of potential future competitors, rather than engaging in commercial negotiations.
- **Standardization and interoperability.** Whenever the policy problem at hand is the insufficient development of a given market due to the lack of commonly agreed standards, the regulator might consider actions aimed at setting a public standard and inviting private operators to adhere to it. In some cases this could prove a winning strategy: for example, there is widespread agreement that Europe's decision to select the GSM standard as the mandatory standard for 2G phones and to select a single spectrum band (900 MHz) for its use was a successful one; however, in many circumstances a top-down approach to the selection of standards can have a strait-jacket effect on the market, which normally can select the *de facto* industry standard more efficiently in a bottom-up way. Similarly, in some circumstances a lack of interoperability between platforms (e.g. in emerging cloud platforms, which might not ensure the portability of data) might call for public intervention: however, forcing interoperability too early in the development of a high-tech market might lead to a risk of "technological lock-in". So-called "open access" remedies, which require that owners of a network or an essential asset have to provide access to market operators, often at fair and non-discriminatory prices, typically belong to this family of regulatory alternatives.
- **Behavioral remedies** imply the prohibition of certain market behavior, and may also not include the setting of regulated prices. For example, mandatory net neutrality obligations are non-price (or, some would say, a zero-price) regulations that mandate non-discriminatory treatment of all Internet traffic, normally with some exception (e.g. spam filtering). Likewise, obligations to grant access to MVNOs, which may or may not be coupled with regulated prices, amount to a behavioral remedy that alters the market structure by promoting the entry of non-infrastructure operators in the wireless telecommunications market. Other access obligations that are

sometimes not coupled with price regulation include wholesale fixed-line broadband access, especially if one looks at the current practice of virtual unbundled local access product (VULA) by Ofcom, the UK regulator. VULA is an electronic means to provide virtual, bitstream-type access that is similar to local physical access (i.e. physical unbundling of fiber or copper local loops and access to ducts), but is currently not coupled with price regulation.

Typically, an important distinction that regulators must make is that between symmetric and asymmetric regulatory remedies, in particular for what concerns behavioral (and other, more intrusive) remedies. The decision to impose a certain remedy only on companies with significant market power and not to others must be made in a way that is consistent with the fundamentals of competition law, and also with due attention to the creation of a real level-playing field in the relevant market.

- **Price regulation** normally follows behavioral remedies, but strengthens them by replacing the outcome of commercial negotiations with an amount chosen by a regulator. Access policy obligations imposed in many countries around the world on incumbent operators typically imply a price set by the regulator based on a specific formula (e.g., the TELRIC or the TSLRIC formulas used to price access to various points of the fixed-line network). Similarly, wholesale access to wireless networks can be coupled with prices regulation. The decision to impose price regulation instead of leaving it to the operators to set their price in commercial negotiations should be taken only when transaction costs are so high that it is unlikely that commercial negotiations would be concluded successfully and at a mutually favorable price.
- **Structural remedies.** These include the functional or structural separation of the network from the associated services. Countries like the UK have decided to impose this remedy early on by functionally separating British Telecom's network from the company's retail operations. Generally speaking, the imposition of structural remedies like functional or structural separation should be considered when there is evidence that less intrusive remedies such as access obligations have failed, for example due to the fact that the incumbent engaged in successful non-price discrimination.

In considering alternative policy options, the following criteria should always be kept in mind by the regulator:

- ***Think outside the box***: options should not necessarily replicate what is already existing in your or in other countries. Rather, they can also be imagined by the regulator, e.g. based on input received from experts, and subject to the criteria identified below (effectiveness, efficiency, proportionality, coherence). Also, remember that some of the options listed above can be combined.
- ***Effectiveness***. In order to represent a feasible regulatory alternative, the option at hand should be feasible to implement and also effective in addressing the policy problem identified. This implies also that if an option would likely face massive non-compliance behavior and limited or no possibility to monitor compliance, it should be discarded at an early stage.
- ***Efficiency*.** Especially when it comes to regulatory options in the telecommunications world, efficiency is a key element for a pre-screening of the feasible alternatives. If you believe a given option will be too costly to be implemented, especially if benefits are not significant, you should discard that option at an early stage to avoid wasting resources.
- ***Proportionality***. An option should not be disproportionate: this implies that the means should be always proportionate to the goal of the regulatory intervention. A corollary of this principle is

that, if regulators find out that, compared to the remedy at hand, a less intrusive option would achieve the same result, then only the latter should be included in the options to be compared.

- ***Coherence***. An important aspect of the feasibility of the options to be compared is their consistency with the overall regulatory framework in place. Check for consistency and policy coherence before including a possible option in the array of the regulatory alternatives to be compared.

Once regulators have selected the alternative options to be compared, the time is ripe to consult targeted stakeholders on the potential impacts of each of the options. Regulators should compile a document containing a draft RIA and the associated proposal, and formulate clear questions as regards:

- The policy problem identified ("Do you agree with the definition of the policy problem, as well as its drivers?")
- The exhaustive nature of the alternative options selected ("Are there alternatives that have been discarded, which would successfully address the policy problem identified?")
- The possible direct and indirect impacts generated by the alternatives ("which of the following impacts will emerge as a result of the implementation of Option X?")
- The data and information that the administration should use to measure such impacts (by providing stakeholders with a list of sources and references and asking them to add those sources that they consider important and are missing from the list).

Increasingly, regulators around the world give themselves minimum standards for consultation. In the EU and the UK, the minimum standard is 12 weeks. In many other parts of the world the length is shorter but normally above four weeks[38].

Question 8. What direct costs are likely to be generated by the available alternatives?

In order to answer this question, the regulator has to consider the various categories of direct cost as illustrated in figure 4 above. This implies the monetization of the following costs:

- **Direct charges**: in the ICT sector, these mostly take the form of fees or royalties. For example, license fees or spectrum fees, QoS fees, copyright royalties, blanket licence fees. Monetizing these charges is normally easy: the most difficult part of the calculation is the determination of the population of stakeholders (business or individual consumers) that will have the obligation to pay the charge, and the likely compliance rate.
- **Administrative burdens:** these can be estimated following the Standard Cost Model or a similar method. This normally requires an analysis of the information obligations introduced by the new regulatory intervention, the type and amount of data to be produced, the time needed to collect and deliver these data, the average hourly salary of the individual(s) that will carry out the activity for a normally efficient firm, plus any acquisition such as the purchasing of equipment or the contracting of an external counsel for the performance of the activity. Monetizing these data

[38] See for the UK, the Code of Practice on Consultation issued in 2008, at http://www.bis.gov.uk/files/file47158.pdf. In the EU, the Commission consults in a variety of ways on the basis of minimum standards which have been in place since 2002 (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0704:FIN:en:PDF). In order to further improve the consultation process, the Commission decided to increase the public consultation period from 8 to 12 weeks as of 2012.

might require the use of empirical techniques such as telephone or face-to-face interviews, focus groups, etc.

- **Substantive compliance costs**: similarly to administrative burdens, these costs – which are normally the bulk of direct costs – can be monetized starting from the types of activities to be performed as a result of new obligations introduced by the various regulatory alternatives, determining the population of firms or consumers that will be subject to the obligation and calculating the cost of compliance per firm. Substantive compliance costs can include *i.a.* investing in new equipment, training personnel or hiring new employees, modify the production process, etc. Calculating compliance costs may require a monetization of both capital costs and operating expenses (CAPEX and OPEX).
- In addition, it is important that regulators compare alternatives in terms of their **enforcement costs**. For example, in deciding over net neutrality the enforcement costs of monitoring QoS over the network might be very high, whereas the option not to monitor might lead to much lower enforcement costs. This does not mean that the former alternative is worse than the latter: all relevant costs must be summed up and compared with benefits before a decision on the preferred option can be made. To account for enforcement costs, regulators should first assess how the various regulatory alternatives will be enforced. This means considering all modes of enforcement where appropriate, ranging from private enforcement in courts (and associated likelihood of settlement before trial); public enforcement by administrative or independent authorities; alternative dispute resolution mechanisms such as ombudsmen, complaint handling mechanisms set up by private regulators, etc. Moreover, regulators must assess costs associated with monitoring and inspections and the likely changes in the quantity and duration of litigation. This means anticipating, where relevant and proportionate, the additional costs that certain regulatory alternatives might generate in terms of additional court cases and additional out-of-court settlements for public administrations as well as private parties such as citizens and businesses. The sum of all incremental costs related to enforcement activities will lead to an estimate of the total enforcement costs for each alternative.

Total direct costs are the result of compliance costs (charges, substantive compliance costs, administrative burdens), hassle/irritation costs where applicable, and enforcement costs. Although not necessary, it is advisable that regulators present them in a disaggregated way, distinguishing between affected stakeholders. In addition, it is essential that total direct costs are presented for each of the policy options under scrutiny.

Question 9. What are the direct benefits expected from the various alternatives?

As shown in figure 4 above, direct benefits include cost savings, improvements of market efficiency and improvements in well-being. For what concerns cost savings, the methods to be used are essentially the same mentioned above for the monetization of costs.

As regards market efficiency, the three most important variables that must be taken into account are:

- ***Consumer surplus***, *i.e.* is the extent to which consumers gain from the possibility to buy the product: it is also measured as the difference between what consumers would have been willing to pay to buy a certain good, and what they actually pay (i.e. the market price). Consumer surplus and price are inversely related – all else equal, a higher price reduces consumer surplus.

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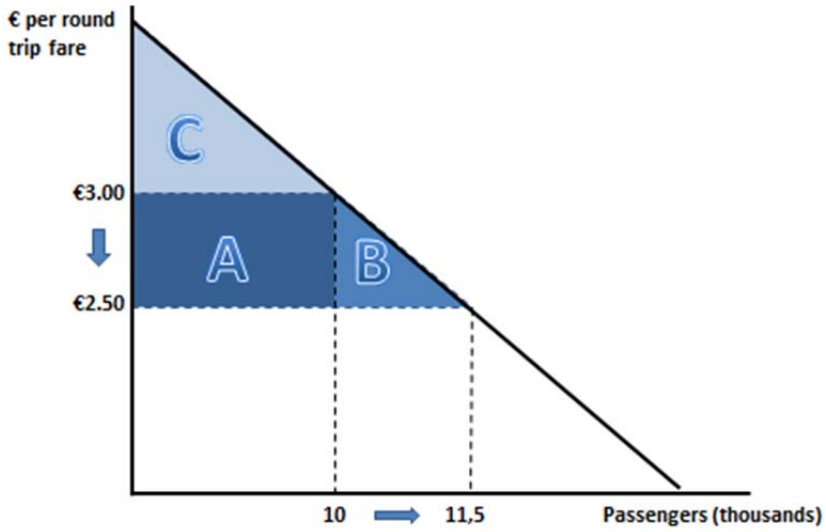
- ***Producer surplus***, which measures what sellers gain out of the sale of a given product, and represents the difference between the actual price and the minimum acceptable price for the producer. Graphically, this area is the area above the supply curve, and below the price level.
- ***Deadweight loss***, *i.e.* this is the part that regulators should be mostly concerned about: if markets do not work efficiently, the output produced might be less than optimal, due to the fact that prices are too high above cost, and some consumers (who value the good at hand more than the cost of producing it) find the good too costly to buy. The value that would have been created by an efficient market can be represented as the consumer surplus that would be generated, were the market at hand functioning more efficiently.

Figure 7 below shows an example taken from the Australian cost-benefit analysis handbook, which assumes the entry of a more efficient bus line in a given market, which brings down prices from €3 to €2.50. The decrease in price leads to an increase in output (1,500 additional passengers now have access to the market). The overall effect is that old passengers gain (area A), and new consumer welfare is created (area B). This adds to the consumer surplus already enjoyed by old passengers (area C).

Figure 7 – Net benefits from enhanced market efficiency



Source: Australian government Cost-Benefit Analysis handbook

In the specific case of ICT, the analysis above might however be too narrow. Of particular importance in this sector are impacts on **dynamic efficiency**, *i.e.* the ability of a market to generate innovation over time. In this respect, it must be recalled that the economic theory is still split over the market structure that is most conducive to innovation and investment over time[39]. However, regulator must

[39] The relationship between competition and innovation is among the most researched issues in economics, especially due to the long-lasting debate between two of the most prominent economists of the past century, Joseph Schumpeter and Kenneth Arrow, who had completely opposite views of the best market conditions that would contribute to stimulating innovation. More recently, the work of Philippe Aghion and various co-authors has shed more light on the potentially beneficial impact of

consider the potential for different regulatory options to stimulate investment in infrastructure and in new services.

For what concerns **improvements in the social and economic condition as well as in health, safety and the environment**, these would be often very difficult to estimate for an ICT regulator, but are also likely to play a less essential role than in other areas of regulation. As explained above, both stated preference and revealed preference techniques can be used to monetize impacts. Recent studies have shown increases in the levels of individual satisfaction associated with broadband penetration: for example, in their study on 29 (mostly European) countries, Kavetsos and Koutroumpis (2011) find that a 10% increase in broadband penetration produces the same lift in the population's subjective well-being as a 2.89% increase in GDP per capita[40].The UK Broadband Impact Study (2013) drafted by SQW for the UK Department of Culture also summarizes the main economic, social and environmental impacts of broadband penetration in the UK[41].

Question 10. What are the likely indirect impacts of available alternatives?

Most of indirect impacts are difficult to monetize. That said, regulators should do their best to answer the following questions:

- **Does any of the alternative policy options create indirect compliance costs ("a negative externality")?** This occurs whenever direct compliance costs imposed by the alternative option at hand would lead to restrictions of output, higher downstream prices or any other additional cost for economic agents other than those targeted by the regulation;
- **Does any of the alternative policy options lead to substitution effects?** In particular, would citizens or businesses other than the regulated entities shift to alternative sources of supply, or alternative modes of consumption? If this is the case, you should try to monetize those benefits by estimating the opportunity cost of the induced behaviour, i.e. the value or surplus foregone by those individuals or businesses that have been induced to engage in the substitute behaviour.
- **Does any of the alternative policy options lead to increased transaction costs?** Transaction costs are normally include the cost of negotiations between parties, e.g. to adopt collective decisions; the cost of information gathering for private parties; the cost of looking for a contractual counter-party; the likelihood of strategic behaviour between private parties; the cost of monitoring a counterparty's behaviour;

competition on innovation and growth. Also, the work of David Teece (1986) has shed a different light on the dynamics of innovation. Rather than adopting a "market structure" approach, like Schumpeter, Arrow and Aghion, Teece considers that most innovative products have to be integrated in a nexus of complementary products to really unleash their full potential. Thus the modularity of modern products and the possibility of integrating innovation into existing system goods becomes one of the essential drivers of product innovation in a given economy.

[40] Kavetsos, Georgios & Koutroumpis, Pantelis, 2011. "Technological affluence and subjective well-being," Journal of Economic Psychology, Elsevier, vol. 32(5), pages 742-753.

[41] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/257006/UK_Broadband_Impact_Study_-_Impact_Report_-_Nov_2013_-_Final.pdf. See also the literature review at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85960/UK_Broadband_Impact_Study.docx.

- **Does any of the alternative policy options lead to a reduction of competition?**More specifically, you have to answer the following questions:
    - Would any of the alternative options make it more difficult for new businesses to enter the market at hand?
    - Would any of the alternative options prevent firms from competing aggressively in the relevant market?
    - Would any of the alternative options make it more likely that firms collude in the relevant market, to the detriment of consumers?

  In all those cases, a monetary value needs to be attached to the likely loss of consumer surplus due to reduced competition. This is inevitably a case-by-case exercise. An example of this is the recent "practical guide" adopted by the European Commission on estimating damages in antitrust cases.
- **Does any of the alternative policy options lead to reduced market access?** A way to assess this indirect cost would be to estimate the lost consumer surplus (for individual consumers), or the lost profit (for businesses) that would occur due to the impossibility to gain access to a given market due to regulatory restrictions or to costs imposed by the regulation on upstream market players.
- **Does any of the alternative policy options lead to reduced investment or innovation?** Common indicators are the level of investment in telecommunications infrastructure, the number of patents produced, the volume of R&D investment, the amount of technology transfer etc.

For what concerns indirect benefits, it is important to assess the differences between policy options at least for what concerns wider macroeconomic benefits. In this respect, regulators can refer to the significant amount of economic literature that demonstrates the relationship between ICT penetration and macroeconomic variable such as GDP. According to recent estimates, a 10% increase in broadband penetration yields an additional 1.21% of GDP growth in high income countries, which rises to 1.38% in low and middle income countries. Similarly, doubling the broadband speed was found to increase an economy's GDP by 0.3% (Qiang and Rossotto 2009 Bohlin et al. 2012)[42].

Question 11. What is the most appropriate criterion for comparing alternatives?

Once information on regulatory alternatives and their potential direct and indirect impacts has been collected, the regulator must process it in a way that is consistent with the ultimate objectives of the regulatory intervention. In most circumstances, cost-benefit analysis will be an appropriate methodology, which will directly point at the most efficient alternative. However, there are cases in which regulators should evaluate the available alternatives in terms of their ability to guarantee specific outcomes or public policy targets. For example, universal access is often a specific policy goal that might, under certain circumstances, conflict with efficiency; social justice, safety, fairness and non-discrimination what also can lead to a similar trade-off. Against this background, it is of utmost importance that the regulator explicitly makes a choice as to which method to use. If no policy goals that are potentially at odds with efficiency are involved, then cost-benefit analysis will certainly be a useful method to reach a meaningful decision; to the contrary, when potentially conflicting issues

[42] Again, the literature review completed for the UK Department of Culture by SQW in 2013 is a useful reference on economic impacts of broadband.

are at stake, multi-criteria analysis will be recommended. Again, whatever the choice, the regulator has to motivate it in a transparent and convincing way.

In case the regulator wishes to perform a cost-benefit analysis, it is essential that the "net present value" of available alternatives is calculated. This requires the choice of an inter-temporal discount rate. The reason is straightforward: regulators will often need to compare alternatives that produce costs and benefits at different moments in time. An option that generates, say, USD50 million of benefits tomorrow cannot be considered equivalent to an option that generates the same amount of benefits, but only in ten years from now. To make costs and benefits comparable, a discount rate should be applied to future cash flows, in order to represent their value today.

If the discount rate were constant at 'r' per cent per year, a benefit of 'B_t' received in '*t*' years is worth $B_t/(1+r)^t$ now. Similarly, a cost of 'C_t' received in '*t*' years is worth $C_t/(1+r)^t$ today. If you assume the discount rate remains constant over the years, the formula for calculating the value of the difference between benefits and costs today (the so-called "net present value", NPV) becomes the following:

$$\sum_{t=0}^{T} \text{NPV} = (B_t - C_t)/(1+r)^t$$

Discount rates used around the world can change significantly. In the EU the current Impact Assessment Guidelines recommend a "default" discount rate of 4%[43]; in contrast, the value of 7% is chosen in Australia and the United States, with sensitivity analyses being mandate for different values (3% and 10% in the US)[44].

Question 12. What are the major risks? Sensitivity analysis

Once the preferred policy option has been selected through an appropriate method, it is important that the regulator performs a sensitivity analysis to ensure that the result is sufficiently robust.This implies a number of possible tests, such as the following:

- **Change the discount rate**. As explained above, you should perform a sensitivity analysis by using different discount rates in your calculation of the net present value. If, even with discount rates of 2% and 6-7%, the preferred policy option remains the same, this indicates robustness of the results.
- **Check for typical pitfalls in cost-benefit analysis**. In particular, certain mistakes should be avoided, such as "double counting", confusing the baseline with the status quo and using an inconsistent base currency.
- **Perform sensitivity analysis on key variables**. The variables that should be allowed to vary to test the robustness of the final data should be linked to the drivers of the problem identified in the problem definition. Possible ways to approach the problem of sensitivity analysis are:

[43] See Commission Impact Assessment Guidelines, SEC (2009) 92, at http://ec.europa.eu/smart-regulation/impact/commission_guidelines/docs/iag_2009_en.pdf.

[44] Commonwealth of Australia, Department of Finance and Administration, 2006, Handbook of Cost-Benefit Analysis, Financial Management Reference Material no. 6. And US Guide to Cost-Benefit Analysis developed by the Office of Information and Regulatory Affairs, Circular A-4, available online at http://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf

- *Worst/best case scenario analysis*: this requires adopting all the most conservative and all the least conservative values for variables used in the calculation of the NPV, and showing a lower bound estimate and an upper bound estimate for the resulting NPVs for each option.
- *Partial sensitivity analysis* (i.e. changing only some of the assumptions, but not other) should be selectively used, for those key risk factors and underlying assumptions that are expected to tilt the balance in favor of one policy option. This is often the case of variables such as the compliance rate, the evolution of consumer demand, etc.
- *Monte Carlo sensitivity analysis* is a more sophisticated technique that entails the creation of a distribution of net benefits by drawing key assumptions or parameter values from a probability distribution. While this is a more robust approach to sensitivity analysis, care needs to be taken in adopting reasonable and justified assumptions about the probability distributions which have been assumed. This type of analysis normally takes the form of a random sampling process to approximate the expected values and the variability inherent in the assumptions which are expressed as probability distributions for the most sensitive and uncertain parameters (risk variables). It is a computer-aided methodology through which many possible project scenarios are generated through a random selection of input values from the specified probability distributions.

If the robustness of your basic assumptions cannot be examined numerically, a qualitative discussion on the appropriateness of each assumption can help readers to gauge the reliability of the results. The outcome of the sensitivity analysis should not be presented as a true, holistic measure of the uncertainty in the results, since there will be many assumptions that are not examined in the sensitivity analysis. Therefore the numerical results of the sensitivity analysis should be presented side-by-side with a discussion of the underlying assumptions that cannot be numerically examined.

- **Assess the likelihood and patterns of compliance**. This implies a reflection on the following effects.
  - *Lack of deterrence, lack of compliance*. The choice to comply with a legal rule can be framed as a rational process. Individuals or businesses that are targeted by a legal rule might decide not to comply with it if the cost of compliance is greater than the likelihood of being prosecuted for having infringed the legal rule at hand. Accordingly, the more difficult it is for enforcers to track non-compliance, the lower the sanction, the less effective the work of enforcers and inspectors, and the greater the benefit from non-compliance, the more likely it will be that the compliance rate will be lower than 100%. This is particularly relevant for all those methods that assume 100% compliance rates, such as the Standard Cost Model.
  - *Behavioural responses to legal rules*. Beyond rational non-compliance, the effectiveness of a given policy alternative might be negatively affected by cognitive effects. The assessment of costs and benefits might be distorted if RIA fails to account for possible behavioral responses by individuals. These include cognitive problems (over-optimism, excess risk aversion, and more generally bounded rationality and rational ignorance); and offsetting behaviour (e.g. individuals drive faster if they have safer cars, such as cars equipped with airbags and electronic stability systems, such that the additional safety benefits expected from this equipment is compensated by the higher speed). If you are comparing “passive safety” measures (which do not require actions by the driver) and

"active safety" measures (which depend on the driver's behaviour), the existence of offsetting behavior can tilt the balance in favour of the former.

Question 13. How will the regulation be monitored and evaluated?

Finally, it is important that ICT regulators define in advance the main indicators that will be used overtime to monitor the performance of the adopted regulation, and an adequate time horizon for the evaluation of the regulation and possible need for reform. Indicators have to be unambiguous and verifiable to the extent possible: examples include retail price levels for broadband (at defined speed); level of broadband uptake; broadband penetration per household passed; entry of new players in the market; data usage per individual broadband subscriber; and many others[45].

5 Conclusions and lessons learned

Our brief "helicopter view" of the main benefits and challenges of implementing RIA in policymaking in the ICT sector, coupled with national experience from several countries, leads to the following main lessons learnt.

First, **there is no one-size-fits-all RIA model that is valid under every sky**. Depending on the institutional setting, the sector of application, the type of legal rules subject to RIA, the most appropriate set of methods and procedure changes.

Second, **RIA is neither a panacea, nor an exercise in rocket science**. RIA provides benefits when it is used with due care, and especially when it is coupled with a broader regulatory reform strategy, with a holistic approach to the policy cycle, and with sufficient guidance on when, and how, to use methods such as cost-benefit analysis.

Third, **the main benefits of RIA come after some time, and thus requires sustained political commitment.** It is very important not to raise expectations too high from the beginning, as the first experiments with RIA might be disappointing, and it will take a while before administrations learn how to draft good RIAs.

Fourth, RIA can significantly contribute to the **efficiency, transparency, accountability and coherence** of public policymaking.

Fifth, **the choice of the methods to be used in a RIA depends on the types of impacts to be assessed and also on the long-term policy goals set by government.** In particular, when a proposal is likely to have important indirect impacts, general equilibrium models can prove superior to partial equilibrium ones; in addition, when the proposal at hand is likely to have significant distributional impacts, CBA may not be the most appropriate choice and multi-criteria analysis, especially if related to the achievement of long-term goals, can be the preferred choice. And when governments introduce RIA in a way that is functional to objectives other than efficiency, the methods and the criteria used to compare alternative options have to be consistent with these objectives.

Sixth, **governance is of the essence** when it comes to designing a RIA system. The essential traits of a well-designed RIA system are the existence of a strong regulatory oversight body, reliable legislative

[45] For an in-depth discussion on monitoring policy implementation, check the GSR14 Discussion Paper on Monitoring the implementation of Broadband Plans and Strategies, www.itu.int/gsr14.

planning in the administration, adequate skills and a results-oriented mindset in the administration, and strong involvement of external stakeholders during the main phases of the policy cycle.

Seventh, **RIA can be usefully applied in the ICT sector**, especially due to the fact that regulators normally possess technical and economic expertise, and can easily consult stakeholders given the sectoral nature of the regulation. At the same time, RIA provides a useful platform for discussing the short- and long-term impacts of regulation, especially when it comes to the trade-offs that regulators often face between static and dynamic efficiency (often in the form of promoting entry of new players v. stimulating investment in infrastructure), and between efficiency as a whole and other goals (universal access, non-discrimination, interoperability, open access, resilience, etc.).

Finally, **it is recommended that ICT regulator use RIA through a multi-criteria analysis**, which implies that regulators make all attempts to quantify and monetize the direct and indirect impacts of regulation, and scrutinize available alternatives also on the basis of additional screens, which enhance policy coherence with the regulator's own long-term agenda.

GSR discussion paper

Monitoring the Implementation of Broadband Plans and Strategies

Work in progress, for discussion purposes

Comments are welcome!

Please send your comments on this paper at: gsr@itu.int by 20 June 2014.

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Monitoring the Implementation of Broadband Plans and Strategies

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Executive summary

Measurable information about the supply and use of broadband provides a basis for judging whether broadband plans and digital strategies are achieving the objectives that have been set.

While strong and effective national plans will reflect local circumstances and priorities, there are many common elements to be considered. Indeed, one of the marks of an effective performance-monitoring regime is the extent to which the key performance indicators adopted allow international comparisons to be made.

This paper therefore includes a brief review of the principles of performance monitoring and looks at the increasingly broad scope of broadband plans before moving on to examine how the implementation of broadband plans and strategies can be monitored.

The argument of the paper is that monitoring needs to be a fully integrated part of broadband plans and strategies – providing an information base for the initial development of plans and strategies as well as for checking the progress of particular policies and programs, and for the evaluation and reassessment of priorities and strategies. Within practical limits, monitoring should provide information on all aspects of the broadband market/ecosystem. The scope of many national broadband plans is already very wide, raising questions about coordination, information sharing and the role of the regulator.

This paper reviews the issues around the monitoring of broadband plans as attention moves from:

- initial *deployment* to make broadband available;
- through projects and programs to encourage the *adoption* and take-up of broadband,
- to *integration* of broadband as a core element in the digital economy.

As that process of development occurs, performance monitoring helps to ensure that targets, costs, benefits and outcomes of projects are measured and programs are well managed.

In the deployment stage, there is a focus of attention on basic telecommunications/broadband indicators of availability obtained from service providers. When attention moves to indicators of adoption and use, barriers to access such as the need for improved digital literacy may need to be identified and overcome by means of projects and programs that will require monitoring and assessment of costs and benefits. Some regulators have adopted innovative ways to expand and apply this information:

- some provide greater detail and depth of information, even down to the local community level;
- some publish this information online to assist both users and suppliers in decision-making;
- some engage in regular reviews of progress, focussing particular attention on the identification of barriers and ways to overcome them.

When high-speed broadband becomes a core element of advanced services in sectors such as health and education, the savings flowing from the use of broadband-based connectivity may outweigh the costs. Within each sector, short, medium and long-term agendas need to take account of the different challenges associated with the deployment, adoption and integration stages, weighing short-term costs against long-term gains. When broadband is fully integrated in these sectors, attention turns to outcomes measured not only in terms of costs and savings, but also in terms of overall gains in capability, efficiency, productivity, innovation and public welfare. New measures may need to be developed to monitor changes in people's behaviour and increased dependence on broadband-based services.

1 Introduction

A recent study shows that countries with a national broadband plan[1] have a better track record for expanding both fixed and mobile broadband penetration compared with countries that do not have a plan. With all other variables held constant, countries with a plan have a 2.5% higher fixed and 7.4 % higher mobile broadband penetration. The study also found that without a competitive market broadband penetration is lower: 1.4% lower for fixed and 26.5% lower for mobile broadband access.[2] A competitive market is a key engine of growth in many broadband plans.

Measurable information about the supply and use of broadband provides a basis for judging whether broadband plans and digital strategies are achieving the objectives that have been set.

While strong and effective national plans will reflect local circumstances and priorities, there are many common elements to be considered. Indeed, one of the marks of an effective performance-monitoring regime is the extent to which the key performance indicators adopted allow international comparisons to be made.

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As that process of development occurs, performance monitoring helps to ensure that targets, costs, benefits and outcomes of projects are measured and programs are well managed. This paper therefore reviews issues connected with monitoring the implementation of national broadband plans with examples of good practices.

Performance monitoring - a brief primer

The overall vision for a broadband-enabled society and economy may be supported by a number of strategies to develop broadband infrastructure and to build human capacity. Common objectives are to extend networks to unserved areas, expand competition, improve the pricing and affordability of services, build capacity and improve digital literacy to support the overall adoption and use of broadband services. Each of these objectives may be resolved into a number of projects. Performance indicators will be

[1] In this paper "*broadband plan*" is used as shorthand to include broadband policies and strategies and digital agendas, while recognizing that each country's choice of language will reflect its own priorities.

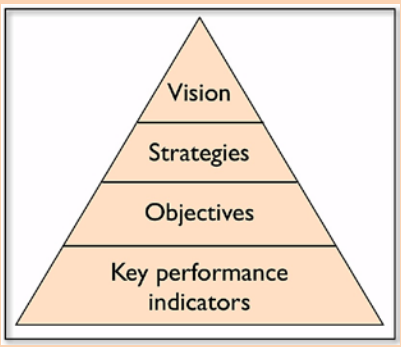
[2] ITU Planning for Progress: Why National Broadband Plans Matter 2013

[3] "Regulator" refers to ICT/telecommunications regulators, recognizing that in some cases regulatory and policy roles in broadband plans may be divided between separate agencies.

required to measure progress against starting points, completion of key component elements and the ultimate achievement of targets and objectives.

Performance monitoring is usually conceived as part of an overall strategic planning framework, often set out in a simple pyramid structure as in figure 1.

Figure 1: Performance monitoring as part of a result-based management framework



Source: author

In a private sector result-based management framework, commercial strategies and objectives can often be translated into key performance indicators and targets for individual teams and staff members. In the public sector it is notoriously more difficult to achieve such clarity of vision. In public affairs there may be a number of competing objectives and strategies, supported by multiple institutional interests, resulting in a lack of "ownership" of the overall project and a focus on process rather than outcomes. At the international level, the Broadband Commission has therefore devoted much effort to building awareness of the importance of broadband at the highest political levels.

Status of broadband indicators and performance indicators

Policy makers and regulators need to ensure that objectives are being achieved. They need reliable, relevant and structured feedback to help them decide whether program adjustments are needed.

The standard broadband indicators have been usefully divided into categories of availability, demand quality and affordability, as shown in figure 2. They are discussed in detail in the World Bank *Broadband Strategies Toolkit*, section 2.4.

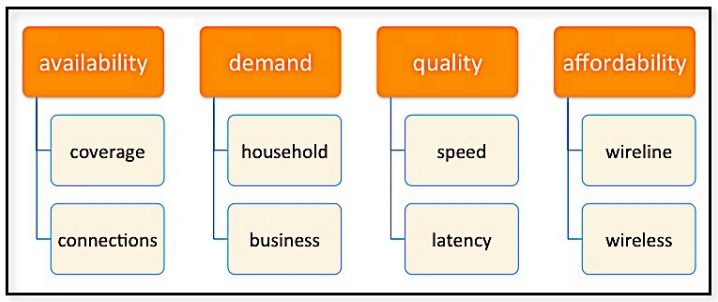
Policy makers and regulators can learn from comparisons with developments in similar countries. Well-established good practice is that national data collection should be based on internationally–agreed standards and definitions, such as those developed by ITU and the Partnership on Measuring ICT for Development.[4] The ITU/BDT World Telecommunication/ICT Indicators Symposium (WTIS)[5] is an important forum in which ITU members work together to keep telecommunications and ICT indicators up-to-date in an environment of rapid change.[6]

[4] http://www.itu.int/en/ITU-D/Statistics/Pages/intlcoop/partnership/default.aspx

[5] http://www.itu.int/en/ITU-D/Statistics/Pages/events/wtis2013/default.aspx

[6] The ITU website holds the current List of the indicators included in the World Telecommunication Indicators/ICT Indicators database, December 2013, of which 26 relate to broadband. The ITU Handbook for the Collection of Administrative Data on Telecommunications/ICT (2011) is a key reference document for the collection of internationally comparable indicators on telecommunications/ICT based on administrative sources (*i.e.* supply-side data mainly from operators). The Handbook includes definitions and methodological clarifications for 81 internationally agreed indicators and corresponding sub-indicators, discussed by the Expert Group on Telecommunication/ICT Indicators (EGTI). The Handbook was released at the

Figure 2: Categories of broadband indicators



Source: adapted from Telecommunications Management Group & World Bank Broadband Strategies Toolkit, Section 2.4

The most useful indicators may also be expressed as targets. Measureable targets focussed on high priority needs and objectives enable progress to be assessed objectively. Given the pace of change in the broadband environment, it is widely agreed that targets should look ahead three to five years and that they should be reviewed regularly to remain both ambitious and realistic. This does not exclude a longer-term vision. Egypt is an example where targets are set in terms of availability, penetration and community access expressed as both short and long-term targets (2015 and 2021) for both fixed and mobile services.[7]

There are different kinds of indicators. As well as the standard telecommunications and broadband indicators other key performance indicators (KPIs)[8] can be used to monitor progress, identify problems, measure costs and benefits and facilitate decisions on any re-direction that may be required in the broadband plan.

- *Quantitative* indicators are presented as a number: examples being customer numbers, traffic volumes, investment totals, and average repair times.
- *Qualitative* indicators may not be expressed as a number but they may be expressed as positive or negative, complete or incomplete, high or low: examples are measures of customer satisfaction, industry competitiveness, ICT readiness, skill levels, program implementation (and in some cases formulas and coding of qualitative information may be applied to express these also as numbers).

Not all indicators are equally useful. Ideally, a broadband plan or strategy should incorporate a manageable number of indicators that:

- relate to high level goals,
- are practical to collect,
- are consistent across countries as far as possible, and
- reveal the extent of progress toward the achievement of measurable targets.

Telecommunications indicators provide well-established measures of "deployment" or "availability" of services (for coverage, connections *etc*.,) but measures of "adoption and effective use" are still being developed. The OECD proposes to include in future work more detailed measures of the adoption and use of the internet by households and businesses, paying more attention to the intensity of use, and

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9th ITU World Telecommunication/ICT Indicators Meeting, in December 2011. The OECD Communications Outlook 2013 Chapter 4 on network dimensions and development also discusses the widening scope of broadband indicators

[7] eMISR National Broadband Plan, Egypt 2011, Executive Summary, page 10

[8] Sometimes also called "key success indicators"

exploring concepts of *technology engagement* and *technology dependency*.[9] The notion of "dependency" aligns closely with the Japanese concept of "indispensability" when applied to online services – a condition where access to the broadband Internet becomes fully integrated into people's lives in a way that makes connectivity a necessity for social and economic life. Such measures usually rely on contracted research and surveys rather than statistical reports from operators and include broader considerations such as the utility of ICTs in achieving social and economic goals.

This paper reflects the spirit of this work in connection with the monitoring of broadband plans as attention moves from:

- initial *deployment* to make broadband available;
- through projects and programs to encourage the *adoption,* take-up and efficient use of broadband,
- to *integration* of broadband as a core element in the digital economy.

2 Coordination and oversight: the monitoring framework

Every country with a broadband plan has its own unique set of social and economic conditions, and its own particular baseline for the development of broadband infrastructure.

Table 1: Overview of key areas in a monitoring framework

Area	Responsibility	Key areas	Information sources
Strategy development: Making good policy choices.	Policy & coordinating agencies with the regulator	**Local circumstances** National priorities State of the market – demand & supply Business case for investment Human capacity	Broad consultation Industry, regulator Economic, financial & social statistics International experience & data
Program management: Tracking progress of projects and programs toward goals & targets.	Regulator & implementing agencies	**Performance Indicators** Costs & benefits Project/program results for broadband access, improvements in capability and efficiency	Regulator Market players Business users Program participants Community leaders
Policy Evaluation: Monitoring development of broadband access infrastructure, prices, affordability and usage.	Regulator, coordinating agencies, & national statistical offices	**Outcomes** Penetration & access Investment, competition & market effectiveness Adoption and effective use Innovation Economic impacts	Regulator Statistical agencies Industry reports Social agencies (education, health *etc.*)

Source: Author, adapted from Broadband Commission The State of Broadband 2013 (Sept 2013) p 78-84

Logically, the work of monitoring broadband development begins with the initial survey of relevant conditions and priorities, considering overall national priorities, the economic and social environment, the unique geographical and other circumstances of the country, and the level of broadband awareness among key stakeholders, government agencies, business and community leaders and the public at large. The Broadband Commission has recommended that priority be given to supporting accurate and timely statistical monitoring because reliable data and indicators are essential for three broad purposes:

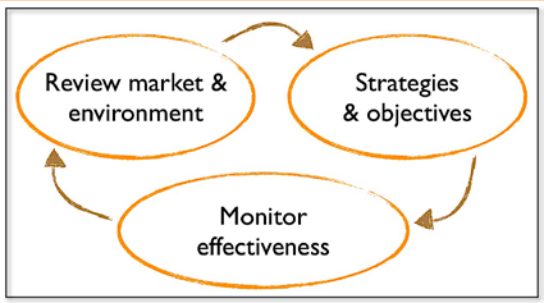
1. Making informed policy choices.

[9] *The Internet Economy on the Rise: Progress since the Seoul Declaration*, OECD, 2013, pages 75-78

2. Assessing the impact of broadband policies and tracking progress toward goals and targets.
3. Monitoring development of broadband infrastructure, access, prices, affordability and usage by individuals, businesses, governments, schools and hospitals.[10]

The structure and approach adopted in this paper largely mirrors these three purposes as illustrated in Table 1 The focus will be on monitoring program management, tracking progress toward goals and targets, and the evaluation of outcomes as the strategy development stage should be already in place. Of course all the information sources that are important at the strategy development stage, including broad consultation, continue to be vitally important as the plan is implemented.

Figure 3: Cycle of policy implementation and improvement



Source: Author

As figure 3 indicates, monitoring should be an integral part of broadband plans in order to provide feedback on implementation and ultimately to support the evaluation of progress and refinement of strategies and objectives. Measurement and management go together: managers need accurate and up-to-date information to enable them to manage their programs effectively, so strategies should be framed with implementation and monitoring in mind.

From broadband development to broadband integration

Table 2 shows how the balance of attention shifts from established telecommunications indicators and measures of availability of service through to outcome measures as broadband becomes more integrated into the wider economy and society. As implementation moves from one phase to the next, much of the work may be embodied in short and longer-term projects and programs to increase the number of users of broadband services and assist the transition to a broadband-enabled society.

In the first phase, monitoring concentrates on broadband network *deployment* to make services available as widely as possible. Standard telecommunications indicators of coverage, capacity, technology take up and price are essential for measuring progress. Where public funding supports rollout programs, more detailed performance indicators will be required to ensure transparency and accountability.

[10] "Policy choices must be informed by reliable data and indicators on ICT developments. Statistical indicators are also essential to assess the impact of broadband policies and to track progress towards national and international broadband goals and targets (including the targets set by the Broadband Commission). Data collected at the national level should be based on internationally agreed standards and definitions, such as those developed by ITU and the Partnership on Measuring ICT for Development. Data should be collected on a timely basis to monitor broadband infrastructure and access, prices and affordability, and broadband usage by individuals, businesses and public organizations such as Governments, schools and hospitals." Broadband Commission The State of Broadband 2013 (Sept 2013) p 84

Table 2: A shifting balance: monitoring successive phases of a broadband plan

Broadband deployment — adoption — integration		
Broadband network availability >	**Broadband access & capacity building for effective use** >	**Broadband integration in economy and society**
Deployment >	**Adoption** >	**Integration**
Examples: optical fibre cable and wireless broadband access networks	*Examples*: digital literacy programs; community access projects and programs	*Examples*: e-health, e-governance, e-education and e-commerce strategies
Telecommunications indicators		
	Performance indicators	
		Outcome measures
Indicators and outcome measures monitor achievements against targets. Performance indicators track program results, costs, benefits and progress against "process milestones" (e.g., for regulations, agreements or contracts).		
Source: author		

The second phase, *adoption*, builds upon the first. Basic telecommunications indicators remain important, particularly those relating to the take up, price, variety and quality of services, and the area of focus expands to include subscription rates, resilience, and quality. Projects and programs promoting access and human capacity need to be monitored with performance indicators tailored to each project to ensure that targets and timelines are met. The costs and benefits of projects supporting both availability and adoption can at this stage be measured and larger social and economic outcomes begin to emerge including changes in consumer behaviour.[11]

A process of evolution opens up the third phase in which the focus is on monitoring and evaluating the social, economic and institutional utilisation of broadband as a fundamental underpinning of the wider use of information and communication technologies in sectors such as health, government, education, commerce, public information and the media. Telecommunications indicators of speed, quality and reliability become more important. Price indicators remain important; although proportionally the cost of broadband may be out-weighed by other ICT-related user costs. Indeed, performance indicators may show that cost savings flowing from *integration* of broadband in areas such as health can greatly outweigh the costs. And so attention turns to outcomes measured not only in terms of costs and savings, but also in terms of overall gains in efficiency, productivity, innovation and public welfare.

Obviously, the three phases are not rigidly separated. ITU broadband data[12] shows that most broadband plans contain elements from at least two and sometimes all three phases (see figure 4). This is appropriate because the demand "pull" is just as important as the supply-side "push" for broadband development and use. For example, rural access projects to expand network reach in developing countries are generally conducted in tandem with programs to build human capacity. Similarly, "digital economy" agendas in countries that emphasise high speed access and applications will continue to feature programs to expand availability and adoption of services in regions that lag behind the main urban and business centres.

[11] The challenges of assessing costs, benefits and economic impacts *ex ante* are discussed by Dr. Raúl L. Katz, *Monitoring the Implementation of Broadband Plans*, ITU/BDT Regional Economic and Financial Forum of Telecommunications/ICTs for Latin America and the Caribbean, San Jose, Cost Rica, March 11-12 2014. Dr Katz comments "considering the amount of investment in ICT, and their economic impact, the amount of data and analysis leading to decisions is typically sub-optimal."

[12] See ITU's ICT Eye portal on ICT data and regulatory information: http://www.itu.int/icteye

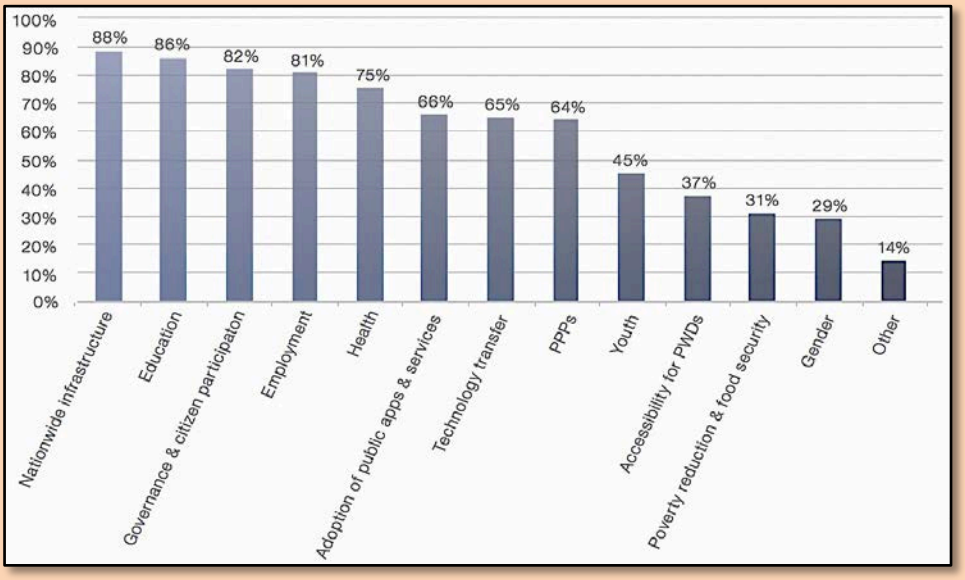
Coordination framework

There are many aspects of broadband plans that fall outside the jurisdiction of regulators, particularly in the areas of adoption and use of broadband and its integration into wider social and economic life, as illustrated in Figure 4. Since broadband and the Internet are multi-purpose technologies with a growing range of uses, it is important to have clearly identified:

- Who owns the plan?
- Who has the oversight and coordination role?
- Who is responsible for monitoring implementation and sharing information about progress?

Different agencies may have responsibility for inter-related aspects of a broadband plan such as market regulation, land access and civil works coordination, ICT use in government agencies, schools and medical centres. High-level government oversight is therefore necessary to provide a framework for cooperation and coordinated implementation of major projects.

Figure 4: Key elements of broadband plans



Source: ITU/UNESCO Broadband Commission for Digital Development, Planning for Progress: Why National Broadband Plans Matter 2013

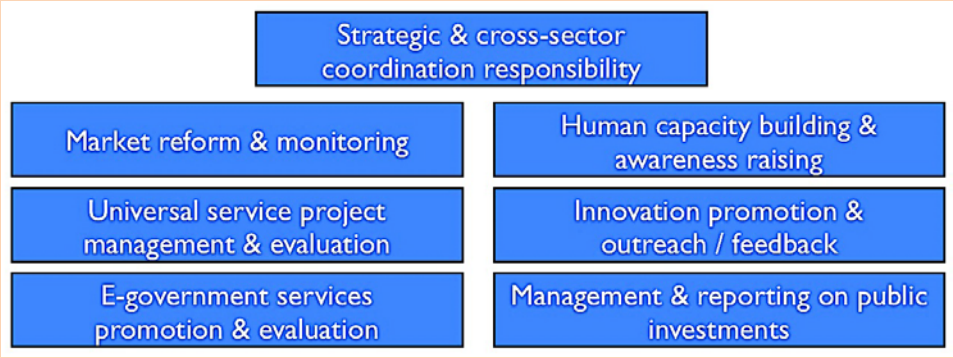
Clearly, where multiple agencies are responsible for different elements of the plan, an overall coordinating framework should be put in place to share information and coordinate initiatives for the supply and use of broadband. Some broadband plans assign the coordinating role to a particular ministry or agency. In Mauritius, for example, a National Broadband Task Force to coordinate the implementation of the National Broadband Policy is established by the Ministry for Information and Communications Technology.[13] In Poland, the Ministry of Administration and Digitization is responsible for the National Broadband Plan's overall implementation, monitoring and updating while other agencies such as the regulator and the economic ministry have important contributing roles.[14] In federal states, where regions or provinces have their own ICT agendas, the issue of centralised or decentralised coordination and monitoring needs to be considered pragmatically, in line with national practice.

[13] Republic of Mauritius National Broadband Policy 2012-2020

[14] Poland, Ministry of Administration and Digitization

Figure 5 offers a generic model of the allocation of roles and responsibilities for implementing and monitoring a broadband plan in which roles are allocated to relevant national agencies within an overall coordination framework.

Figure 5: Allocation of roles and responsibilities in implementation and monitoring of a broadband plan



Source: author

Such a framework will facilitate coordinated action on cross-sector activities and ensure maximum transparency of purpose and progress as the various elements of a broadband plan are implemented. It should also help to ensure that:

- market initiatives and other forms of innovation are encouraged and supported, with feedback to ensure that all stakeholders are fully informed of developments;
- responsibility for ICT education and human capacity building is allocated to the agencies best placed to support the requirements of both the industry and users;
- responsibility for promotion and public awareness activities is appropriately assigned and funded;
- information on complementary programs is shared and published; and
- regulatory matters are handled in such a way as to support the overall broadband agenda.

3 Measuring and managing the implementation of broadband plans

Regulators have a central role to play in monitoring the implementation of broadband plans. Even where responsibility is shared with other agencies, the regulator may play a number of key roles as

- the leading agency on telecommunications regulatory matters,
- the repository of industry statistics and publisher of key indicators, and
- a leading source of expert advice on technical, industry and consumer issues.

Depending on national arrangements, the regulator may also have an implementing or contributing role in areas including:

- spectrum allocation for wireless broadband services,
- administration of universal service funds,
- industry promotion and development,
- regulating competition and investment in the supply and use of broadband services,
- civil works coordination in support of broadband infrastructure, and
- ICT and media regulation more broadly.

While there may be differences in national arrangements, it is important that regulatory agencies play a lead role as independent providers of information about the development of the broadband environment, and the growth of broadband access and adoption. They also have a lead role to play as thought leaders and broadband champions since they will generally be the best-informed agency on broadband issues.

Much has been written about the need for an enabling environment to support broadband deployment. Where the key elements are not yet in place, it may be necessary to monitor their development through to completion so that all the essential building blocks will be in place.

Are key elements of an enabling framework in place? A checklist

Appendix A provides a checklist of items that may be included in a monitoring plan. The following discussion of elements of an enabling framework may or may not be relevant to a particular country, depending on the extent to which a broadband policy has been developed and implemented.

✓ Regulatory scope held

Broadband brings challenges including the convergence of previously separate communications services, and the regulator's mandate may need to be adjusted or expanded to deal with issues including convergence, competition, consumer issues and spectrum reform if it is to perform an enabling role in implementing broadband plans.

✓ Regulatory capacity enhanced

Similarly, the regulator will need staff with the skills and knowledge to carry out its role. Ongoing staff development and enlistment of expertise will be required to deal with the challenges of implementing broadband strategies and plans. The *Connecting Africa Report* 2013 reviewed connectivity, universal access policy, the regulatory framework, ICT skills and e-applications and found that broadband was the "single most critical element stimulating growth." It found that much had been achieved in terms of connecting major cities and towns, and that village-level mobile and wireless access had improved, but that skills development remained a broad concern, and that "capacity building in key economic and technical regulatory aspects such as licensing, universal access, frequency management, numbering, interconnection, data management, digital migration and cyber-security is essential." [15] Building and maintaining the skills and capacity of broadband policy and regulatory agencies will remain important in meeting the challenges ahead.

✓ Broadband plan in place

There remain some countries where no formal broadband plan or strategy is in place. In that case, the progress of policy development work, including consultation, information gathering and preparation of draft proposals, may need high-level consideration.[16]

✓ Spectrum reform for optimizing the provision of wireless broadband access

Spectrum reform and provision for wireless broadband access are pressing issues in many developing countries because wireless offers the fastest and cheapest service to remote, rural and highland areas and it offers the benefits of strong synergies between basic voice and broadband data-intensive services.

Spectrum access problems sometimes arise from cumbersome institutional arrangements that can only be overcome by institutional reforms. Otherwise, the allocation of spectrum for wireless broadband

[15] Connecting Africa: An Assessment of Progress Towards the Connect Africa Summit Goals, African Development Bank 2013, page 79

[16] In the European Union a satisfactory broadband plan is a precondition for the use of structural and cohesion funds from the European Union budget to support broadband upgrades.

access can be delayed.[17] Access to spectrum will be a vital element in the business plans of potential broadband wireless access networks. Investment in wireless broadband access therefore needs to be supported by a clear timetable for the provision of the necessary spectrum access, and by transparent monitoring of progress in clearing the relevant radio frequency spectrum where that is required.

✓ Simplified licensing to facilitate broadband service expanded

Rigidities in licensing arrangements can also hold back broadband development. For that reason, many regulatory authorities have been moving to simplifying licensing arrangements both to unify previously separate licences and to remove unnecessary technological restrictions. Unified and technology neutral licences give licence holders the ability to modernise and extend their services without unnecessary regulatory constraints or excessive fees. Introduction of a broadband plan can provide an opportunity to include licensing reforms in the overall implementation timetable.

✓ Telecommunications indicators systematically reported

Basic telecommunications indicators on the number of services offered, subscriber numbers and traffic volumes by technology and service type remain an essential tool for policy makers, regulators and industry in developing and monitoring their broadband business plans and policies.

✓ Civil works facilitated

A high proportion of the cost of network construction arises from civil works. To reduce costs, delays and inconvenience, major infrastructure rollouts require clear protocols to be in place with local governments and agencies responsible for roads, railways and energy supplies. This is an area in which process milestones are useful – not just achievement targets – since it involves cooperation with a number of stakeholders, identification of specific obstacles, development of collaborative processes and potentially changes to regulatory arrangements to protect the interests of both network builders and property owners. Some examples will be discussed in following sections.

✓ Infrastructure sharing facilitated

The high cost of civil works and passive infrastructure relative to the overall investment in broadband also means that infrastructure sharing should be facilitated in order to reduce the overall cost of investment. Barriers should not be placed in the way of commercial arrangements for infrastructure sharing and there will be cases where regulatory action is required to ensure that competitors have access to bottleneck facilities. Infrastructure sharing may also extend beyond telecommunications networks: there can be strong synergies with energy utilities, for example, both in extending access to rural and remote areas and also reducing network rollout costs in built-up areas. The European Commission estimate that new measures to reduce costs of deploying infrastructure (including sharing of passive infrastructure, transparency and coordination of civil works, streamlined permit granting procedures and more buildings ready for high speed network access) could reduce investment costs by 20-30%.[18]

There may also be scope for cooperation in sharing of backbone facilities. Competing operators often prefer to maintain independent backbone networks, but regulatory agencies may facilitate cooperation in sharing of passive facilities and the construction of shared backbones where that is the most cost-effective way of extending the reach of broadband networks into unserved areas.

[17] These issues are explained in detail in ITU Guidelines for preparation of national wireless broadband masterplans for the Asia Pacific region

[18] Filippo Munisteri, Broadband policy development and implementation in the EU, Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013

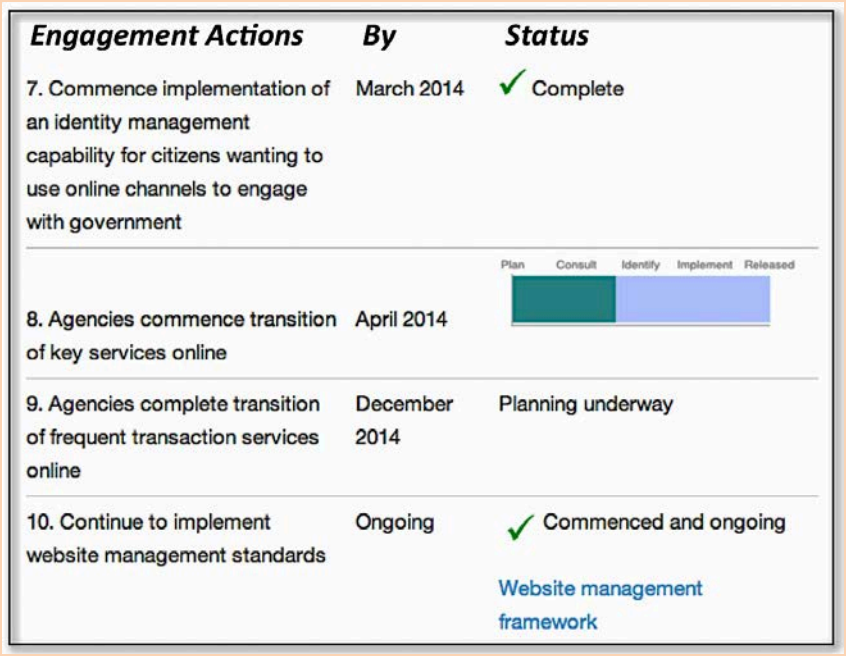
✓ Gateway access facilitated

International connectivity and gateway access is essential for broadband network operators. Regulatory agencies may need to take steps to facilitate open access arrangements on commercial terms, and, where necessary, to ensure diversity of access and protection of essential facilities.

* * *

The summary checklist in *Appendix A* includes measures that may require to be monitored in the implementation of a broadband plan. Not all the elements in this list are essential in every country, but the relevant elements should form part of the checklist of measures to be monitored for effective implementation of a broadband plan. Many of these elements can be monitored in a simple "traffic light" report, which can be maintained by the regulator or coordinating agency and published online, indicating the status of key actions and building blocks. Progress can be expressed in terms of whether consultation has begun, reports completed, regulations changed *etc*. Figure 6 provides an extract from the online report by the State of Victoria[19] on the progress of its ICT strategy as an example of how this can be done.

Figure 6: Extract from an online status report: Digital Victoria



Source: http://www.digital.vic.gov.au/status/ (as at 12 November 2013)

The European Commission and the Federal Communications Commission in the United States similarly maintain information about progress of their digital agenda and broadband plans on their *Digital Agenda for Europe* and *Broadband.gov* websites, with checklists marking progress in the work schedule.[20]

Ease of doing business

Broadband cannot be considered in isolation from the wider economy. Investors in broadband, as in any other sector, will be concerned about the overall conditions for doing business. The International

[19] In Australia's federal structure, states such as Victoria have a key role to play in the development of e-government and other elements of the digital economy.

[20] FCC 2010 Quarterly Broadband Action Agenda Items; European Commission Rules to support a competitive single market and to foster innovation and investment and Action 45: Foster the deployment of NGA networks

Finance Corporation and The World Bank maintain an online database[21] to monitor issues that will affect the prospects for investment, assessing a range of potential problem areas including:

- Starting a Business
- Dealing with Construction Permits
- Getting Electricity
- Registering Property
- Getting Credit
- Protecting Investors
- Paying Taxes
- Trading Across Borders
- Enforcing Contracts
- Resolving Insolvency

Problems in any one of these areas can be a serious impediment to broadband investment. In some countries the needs of the telecommunications sector have called for a more advanced legal and logistical framework than exists in the economy at large. For example, if construction permits are unduly difficult to obtain, the facilitation of civil works in telecommunications networks may require special arrangements to overcome the difficulties. In some countries, therefore, these essential investment conditions may also need to be referenced when monitoring the implementation of a broadband plan.

Monitoring broadband network deployment, availability and adoption

Table 3 outlines some of the key categories and characteristics to be considered in broadband infrastructure development for both fixed and wireless networks.

Table 3: Broadband construction overview and prospects for return on investment (ROI)*

<table>
<tr><th></th><th colspan="2">Fixed network</th><th colspan="2">Wireless network</th></tr>
<tr><th></th><th>Incumbent</th><th>New entrant</th><th>Incumbent</th><th>New entrant</th></tr>
<tr><td>Backbone / trunk routes</td><td rowspan="2">Fibre network construction as part of a capital equipment enhancement and replacement program: commercial ROI</td><td rowspan="2">New infrastructure requires access & interconnection to achieve a commercial ROI</td><td rowspan="3">Re-use of existing passive infrastructure: commercial ROI</td><td rowspan="3">New infrastructure requires access & interconnection: commercial ROI</td></tr>
<tr><td>Central business districts</td></tr>
<tr><td>Urban areas (small business & homes) – “brownfields”</td><td>Copper enhanced or replaced with fibre: longer-term ROI</td><td rowspan="2">Unbundled access generally required to achieve a commercial ROI: new infrastructure construction may provide a commercial ROI in some cases</td></tr>
<tr><td>New estates – “greenfields”</td><td>New capital investment in fibre: low maintenance cost: commercial ROI</td><td colspan="2">New infrastructure: commercial ROI</td></tr>
<tr><td>Rural and remote areas</td><td colspan="2">High cost and slow/negative ROI
New wireless infrastructure may be dominant over limited/declining/absent fixed line access</td><td colspan="2">New infrastructure required: possible universal service fund (USF) support: slow ROI</td></tr>
<tr><td colspan="5">Source: author
* Note: “commercial” or “slow” ROI are relative terms. In different countries and conditions the rate of return on investment may vary widely. In small island states, for example, the cost of international connectivity for small populations may bring additional challenges.</td></tr>
</table>

[21] The Doing Business website (http://www.doingbusiness.org/rankings) provides rankings and commentary on each issue.

It identifies some of the issues to be considered and monitored as broadband networks expand from profitable business centres and trunk routes into wider urban areas and out to rural and remote populations where the business proposition for commercial coverage may be difficult to establish. The deployment and adoption of broadband may need to be measured separately for each market segment.

Standardised broadband indicators are available in almost all countries and regular publication by the collecting authority makes it possible to track progress. The Nepal Telecommunications Authority's regular reporting, for example, includes information on internet access services provided by each operator as well as providing a breakdown of different technologies and the number of subscribers.[22]

The Polish regulator, the Office of Electronic Communications (UKE) annually updates its inventory of telecommunications infrastructure and public telecommunications networks that support broadband Internet access, including fibre and wireless networks as well as buildings that support collocation of facilities. The scope of data gathering, the electronic form of its submission and the map presentation format of the data are defined in an ordinance. UKE has also collected details of the current condition of the infrastructure and information on investment projects including fibre optic network terminations, telecommunications network nodes, access nodes, coverage with cable and wireless networks and penetration of cable connections or wireless terminals in buildings. This information is held in a dedicated database called the Information System about Broadband Infrastructure (*System Informacji o Infrastrukturze Szerokopasmowej*, SIIS). Detailed information is presented in the form of tables, charts and maps at the Polish province level (with information at the commune level).[23].

This information makes it possible to perform a detailed assessment of the condition of broadband infrastructure and to identify specific, long-term investment and development targets at the local level. Telecommunications companies and local government units, with the support of UKE, can use the data to help them in making effective investments in the infrastructure and in long-term planning of telecommunications infrastructure development. The data is also used to estimate the level of necessary investment (a key item in the National Broadband Plan). It helps local government and other local agencies in their decisions on investment projects financed with public assistance, and consumers can use it as a tool to help them select the most attractive telecommunications technologies and the most competitive market offers. UKE also publishes a report on coverage of the territory of Poland by telecommunications infrastructure. [24]

Other countries that make interactive maps available to consumers include Australia, Canada, Germany, Ireland, New Zealand, the United Kingdom, and the United States where a number of cities and states also provide broadband maps.[25] At the international level, ITU is currently mapping the deployment of backbone transmission capacity (both fibre and microwave) to enable governments to track and measure progress made in achieving their broadband infrastructure development goals (see figure 7). The map has capability to zoom from global to regional and local levels. [26]

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[22] Nepal Telecommunications Authority MIS Reports

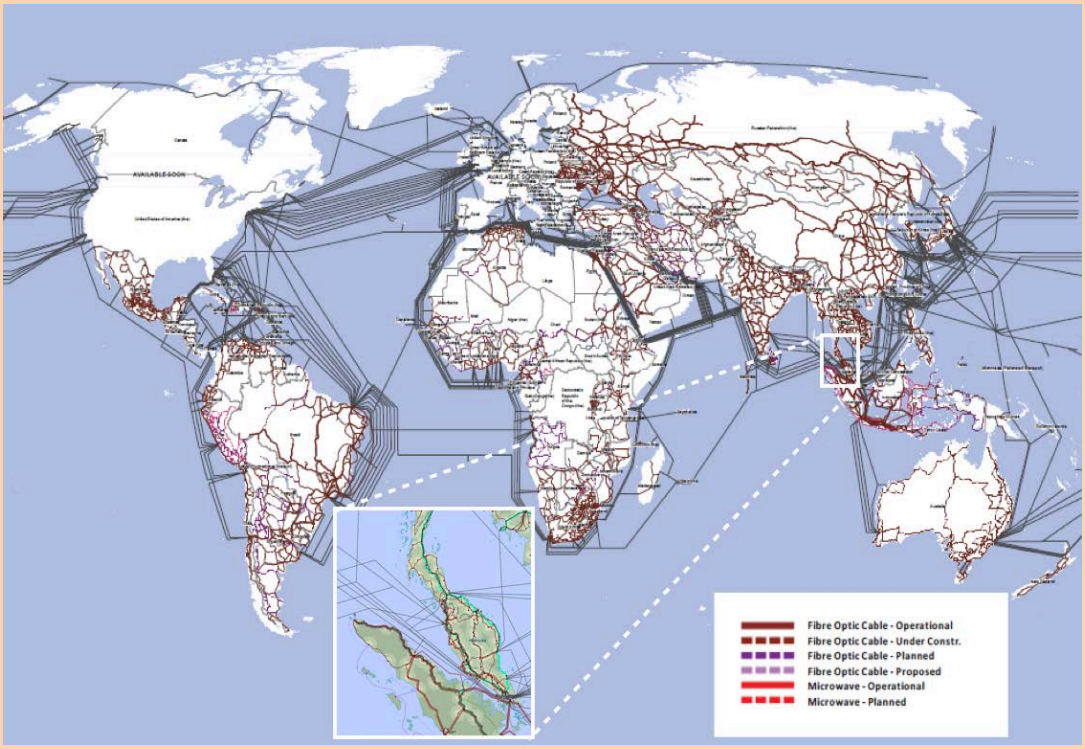
[23] Interactive maps presenting broadband infrastructure are available at http://maps.polskaszerokopasmowa.pl/maps .

[24] The Report of August 2013 (including investment projects implemented in 2012-2013, and buildings enabling co-location) is available in English on UKE website (http://en.uke.gov.pl/telecommunications-infrastructure-in-poland-12958). Anna Rogozińska, *From National Broadband Plans towards Broadband Ubiquity – the Polish Experience*, ITU-D Regional Conference on Speeding up NGN ubiquity, Athens, 13 February 2014, supplemented by correspondence with the author.

[25] Interactive broadband maps available online include: Australia (https://www.mybroadband.communications.gov.au), Canada (http://www.ic.gc.ca/app/sitt/bbmap/hm.html?lng=eng), the United States (http://www.broadbandmap.gov), Germany http://www.zukunft-breitband.de/Breitband/DE/Breitbandatlas/breitbandatlas_node.html, Ireland (http://www.dcenr.gov.ie/communications/communications+development/national+broadband+scheme.htm), New Zealand (http://www.broadbandmap.govt.nz), and the United Kingdom (http://maps.ofcom.org.uk/broadband/). In June 2013 the EC commissioned a study of current broadband mapping initiatives (http://www.broadbandmapping.eu/).

[26] Currently, data from 113 countries have been collected. For more information on this project and to access the interactive map, see http://www.itu.int/itu-d/tnd-map-public/

Figure 7: ITU's backbone transmission map – with an example of interactive regional mapping capability



Source: ITU, Telegeography, www.itu.int/itu-d/map-public/ Note: data collection for this map is a work in progress

In the United Kingdom, reports from the regulator Ofcom make comparisons with peer countries in Europe on measures of coverage, take-up, usage, price and choice.[27] In the United States, the Federal Communications Commission (FCC) is required to include information comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) with a total of 75 communities in at least 25 countries abroad for each of the speed benchmarks for broadband service utilized by the Commission to reflect different speed tiers.[28] Most countries rely on ITU, OECD and other regional organisations to provide comparative information of this kind.

Monitoring the progress of a broadband plan is of most value when the information is shared. New Zealand and the United States both publish a great deal of information on the web although they approach the task in different ways. New Zealand publishes regularly updated information online about the progress of the Ultra-fast Broadband Initiative, the Rural Broadband Initiative and the connection of schools and rural hospitals. The report of 30 June 2013 (figure 8) can be considered as a model of concise reporting.

The United States' *National Broadband Plan: Connecting America*[29] provides a framework for expanding broadband connectivity, adoption and utilisation across the nation. The Plan put forward an initial universal service goal for broadband access at 4 Mbps of actual download speed and 1 Mbps of actual upload speed by 2020, estimating that in 2009 this level of access was already available to 95% of the population, largely as a result of private sector investment. The availability gap was greatest in areas with low population density where the business case for broadband networks was unattractive.

[27] Ofcom Report for Government on UK's broadband progress March 5, 2013

[28] FCC Eighth Broadband Progress Report, August 2012, page 52

[29] *National Broadband Plan: Connecting America*

Figure 8: New Zealand: Broadband deployment update as at 30 June 2013[30]

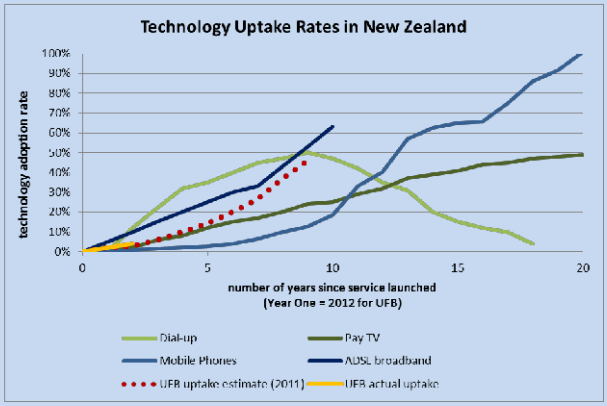
Ultra-fast Broadband Initiative (UFB)

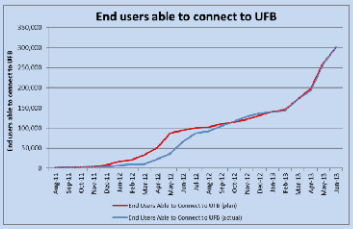
Connecting 75% of New Zealanders with fibre to the premise by end 2019. Fibre will be capable of peak speeds of at least 100Mbps.

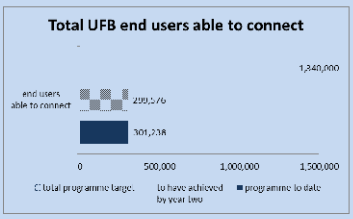
	# of premises able to connect			# of end users able to connect			# of connected users		
	quarter four	year two	to date	quarter four	year two	to date	quarter four	year two	to date
TOTAL	95,818	171,331	229,633	129,352	224,927	301,238	4,851	8,751	9,984

Number of retail providers actively offering UFB services: 50

Ultra fast broadband connections are now available in 26 candidate areas. For information on whether you can connect to UFB, please contact your retail service provider or go to www.broadband.govt.nz







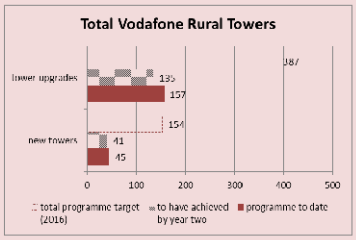
Rural Broadband Initiative (RBI)

Connecting 86% of rural homes and businesses (outside UFB areas) with broadband at peak speeds of at least 5Mbps by end 2015, through fixed wireless and improved copper services.

Vodafone

Role: provision of fixed wireless broadband capable of peak speeds of at least 5Mbps.

	quarter four	year two	to date
towers upgraded:	12	77	157
new towers installed:	9	32	45
households covered (approximate):	10,930	58,127	111,050

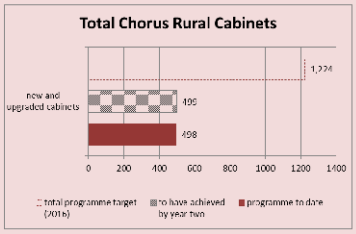


Chorus

Role: deployment of fibre to cabinets, offering improved broadband services. Some residences will receive copper-based broadband speeds of up to 20Mbps.

	quarter four	year two	to date
cabinets upgraded:	91	289	498
households covered (approximate):	7,720	31,092	50,120

Some rural homes and businesses will have the choice between copper-based broadband and fixed wireless broadband. Currently over 149,000 homes have access to RBI services.



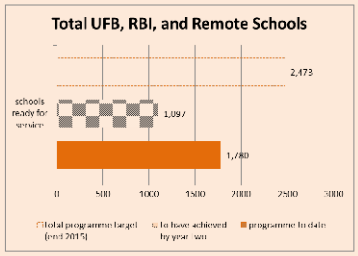
Priority Users

To be connected with fibre capable of peak speeds of at least 100Mbps through the UFB or RBI. Remote schools will receive point-to-point wireless connections capable of peak speeds of at least 10Mbps.

Schools

	quarter four	year two	to date
UFB: schools with fibre past the school gate	124	832	1008
UFB: schools with fibre connections (ready for service)	176	623	973
RBI: schools with fibre past the school gate	83	294	779
RBI: schools with fibre connection (ready for service)	83	313	774
remote schools (ready for service)	7	23	33

Note: The programme target covers state and state-integrated schools. It includes schools that have been connected to fibre outside of the UFB and RBI.



Hospitals

	quarter four	year two	to date
rural hospitals with fibre connections	8	24	28

Note: number of hospitals includes eight rural hospitals connected to fibre prior to the establishment of the RBI.

Source: [Ministry of Business, Innovation and Employment: Broadband Deployment Update]

[30] Quarterly updates continue to be published by the Ministry of Business, Innovation, and Employment

The importance of monitoring broadband progress is underlined by the legislative requirement for the FCC to initiate an annual notice of inquiry "concerning the availability of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms).

In conducting this inquiry, the Commission must "determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." It must also provide demographic information for unserved areas. If the Commission finds that broadband is not being deployed to all Americans in a reasonable and timely fashion, the Commission is required to take immediate action to accelerate broadband deployment by removing barriers to infrastructure investment and by promoting competition in the telecommunications market.[31]

United States – Eighth Broadband Progress Report, 2012

As part of its statutory duty, the FCC has reported that many Americans live in areas where there is no business case to offer broadband; they have no immediate prospect of being served absent Commission action, despite the growing costs of digital exclusion. This was an important element in the Commission's finding "that broadband is not being reasonably and timely deployed and is not available to all Americans."[32] The speed benchmark adopted by the FCC for the purpose of this finding was 4 Mbps/1 Mbps – a benchmark that it will review in future inquiries.

Drawing upon its own resources as well as research findings from a variety of sources, the FCC's previous report had identified several barriers to investment, competition and adoption in these areas:

- costs and delays in building out networks;
- broadband service quality;
- lack of affordable broadband Internet access services;
- lack of access to computers and other broadband-capable equipment;
- lack of relevance of broadband for some consumers;
- poor digital literacy; and
- other reasons, such as consumers' lack of trust in broadband and Internet content and services, including concerns about inadequate privacy protections.

The FCC's *Broadband Progress Report* noted that the private sector was continuing to extend the reach of services. Barriers to broadband availability and adoption were also being overcome through the implementation of a number of programs managed by itself and other agencies to support the rollout and adoption of broadband services in tribal lands and other under-served areas, with a mix of strategies to support both the availability and adoption of broadband services through partnerships, targeted subsidies, and regulatory streamlining activities, noting that it continued to find strong interrelationships between deployment, competition and adoption. For example, universal service policies had been reformed to emphasise broadband access, and major funding was provided through the US Departments of Agriculture and Commerce, as well as the FCC, to provide grants and loans to support deployment in unserved, remote and high cost areas. Regulatory initiatives such as the *Pole Attachment Order* were launched to cut costs and accelerate deployment, and spectrum was being made available to support wireless broadband access. To support broadband adoption and overcome barriers of cost, literacy and perceived lack of relevance, programs such as *Connect to Compete* were collaborating with private and community organisations to assist low income users with low cost computers and Internet service, with content to support job skills and education, and with accessible digital literacy training programs.[33]

[31] FCC Eighth Broadband Progress Report, August 2012, page 8

[32] FCC Eighth Broadband Progress Report, August 2012, page 9

[33] FCC Eighth Broadband Progress Report, August 2012, page 62-69

The report focussed particular attention on the need to remove difficulties in accessing key requisites for broadband infrastructure, such as utility poles, conduits, rooftops, towers and rights-of-way. "These obstacles delay or prevent broadband deployment, and are likely to limit competitive entry, raise costs, lower service quality and have other negative impacts on businesses and consumers." [34] The response to these barriers clearly required cross-jurisdictional cooperation. This was ultimately given direction by the President's *Executive Order -- Accelerating Broadband Infrastructure Deployment* of June 2012.[35]

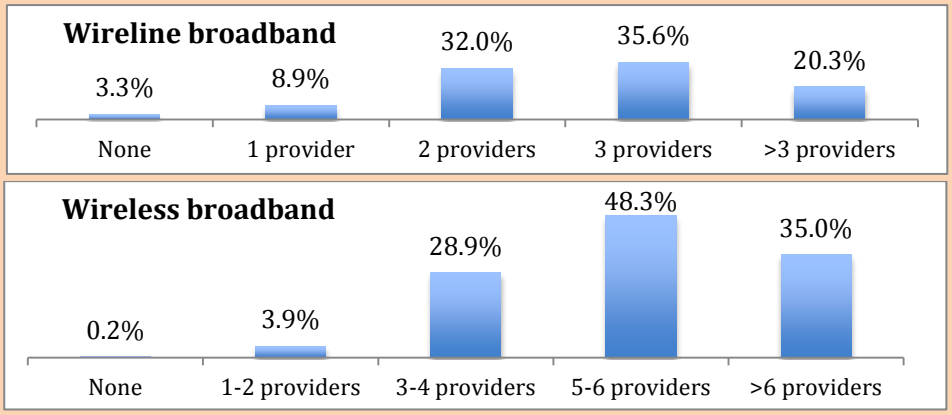
Source: author, adapted from FCC.

Future Broadband Progress Reports will continue to provide updated information on these issues – both in terms of the expansion of broadband availability and adoption and the progress of measures required to deal with the various barriers that have been identified.

Monitoring competition and wholesale access

While basic enabling measures can be reduced to a checklist, and standardised telecommunications indicators will measure broadband availability, monitoring the development of a competitive broadband market is important for those countries that rely on the market to do the great bulk of the work in achieving widespread and affordable broadband access. This requires information on the extent of infrastructure and service-level competition, and the interactive maps mentioned earlier can provide a useful way of monitoring the development of competition.

Figure 9: Nationwide availability of broadband in the U.S. by number of competing providers



Source: Adapted from Steven Rosenberg *Measuring and evaluating broadband progress,* Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013*, based on the National Broadband Map at June 30, 2013*[36]

Figure 9 provides a breakdown of the competitive availability of broadband in the United States based upon information provided by State Broadband Initiative grantees[37] and incorporated in the National Broadband Map.[38] While figure 9 provides an indication of the extent of competition at the national level, the interactive features of the National Broadband Map enable users to obtain similar information also at state and local levels, identifying local broadband providers.

[34] FCC Eighth Broadband Progress Report, August 2012, page 62-63

[35] The White House Executive Order -- Accelerating Broadband Infrastructure Deployment, June 14, 2012

[36] In this case, the benchmark speeds used for broadband are 768 kbps down and 200 kbps up.

[37] The State Broadband Initiative (SBI – previously the State Broadband Data Development program) is discussed later under monitoring adoption of broadband.

[38] *Steven Rosenberg* Measuring and evaluating broadband progress, *Presentation for ITU Asia Pacific Centre of Excellence Training, October 2013*

In Europe, there is reporting on service as well as infrastructure-based competition, and action lines in the Digital Agenda support streamlined regulatory measures for wholesale access pricing.[39] The Commission monitors the extent of wholesale access from incumbents in terms of activated main lines, whether shared or fully unbundled lines, bitstream access or simple resale. This information is obtained from national regulators and is published online.[40]

Wholesale level information is also required in those cases where vertically separated models have been adopted for broadband provision. Two broad approaches to vertical separation can be distinguished:

- separation of wholesale and retail services by an existing incumbent (*e.g.*, the United Kingdom and New Zealand creating Openreach and Chorus, respectively), or
- creation of a new entity to supply basic infrastructure on a wholesale basis (*e.g.*, Australia and Singapore).

Although the United Kingdom and Singapore represent the first and second approaches respectively, they appear to be converging in their approach to monitoring the performance of the wholesale service provider and the achievement of rollout targets.

- In the *United Kingdom*, since the beginning of 2013, Openreach has committed to new contractual targets for services, leading to automatic payments to other telecoms companies where it misses those targets. Ofcom has also proposed new performance standards for Openreach with targets to be met in full from April 2016. Intermediate targets are also proposed to ensure progressive improvements in service. The Openreach website provides information on where and when superfast broadband is becoming available.[41]
- In *Singapore* OpenNet is the wholesale provider of Singapore's National Broadband Network (NBN). OpenNet's universal service obligation (USO) requires it to provide optical fibre services to any location in Singapore at the request of telecom or broadcast licensees. Operating companies and retail service providers rely on OpenNet's NBN to deliver services to consumers and businesses and OpenNet provides information about the availability of broadband service to specific locations on its website. In December 2013, the Infocomm Development Authority of Singapore (IDA) imposed a financial penalty of SNG $750,000 on OpenNet for failing to meet its USO from January to June 2013 as well as for breaching its Quality of Service standards. The IDA notice on this matter also reported that since July 2013 OpenNet has been accepting orders for fibre services to all homes and business end-users in observation of its USO.[42]

Close monitoring of broadband progress is also occurring in Australia and New Zealand, measuring progress against public statements of expectations and commitments. As the wider economy becomes more dependent upon fully integrated broadband and ICT services, the performance of providers at the wholesale level may be more closely monitored. As the IDA noted in their decision of December 2013, a performance lapse at the wholesale level affects downstream providers such as operating companies and retail service providers who rely on the wholesale network to deliver a wide range of services to consumers and businesses.

Before moving on, it is useful to reflect that while it is true that broadband indicators of availability are well established, many countries have adopted innovative ways to expand and apply this information:

- some provide greater detail and depth of information, even down to the local community level;

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[39] Digital Agenda for Europe Pillar IV: Fast and ultra-fast Internet access, actions 112-114

[40] European Commission Report: Fixed broadband wholesale lines & agreements, January 2013

[41] Ofcom New rules for faster telecoms repairs and installation December 19, 2013 and Openreach: Where and when

[42] OpenNet, homepage and IDA, OpenNet Failed to Meet Universal Service Obligation and Quality of Service Standards 20 November 2013

- some publish this information online to assist both users and suppliers in decision-making;
- some engage in regular reviews of progress, focussing particular attention on the identification of barriers and ways to overcome them; and
- in the case of countries where wholesale access is being rolled out in a vertically separated way, new approaches have been adopted to set requirements and hold the responsible body to account for the achievement of its targets and obligations.

Expanding broadband in unserved areas – project monitoring and evaluation

So far this paper has focussed on monitoring the development of broadband in areas where a commercial return on investment is generally achievable over an acceptable period of time and broadband plans can rely largely on the market or on a mix of commercial and regulatory incentives. In the most challenging rural and remote areas, as noted in table 3, the potential return on investment may be so poor that a business case does not exist for broadband deployment without a direct injection of public funds.

Whether or not a rural broadband project is formally part of a universal access policy, it may need to be monitored and evaluated in similar ways, recognising that broadband-capable networks are now being extended to areas that would once have been restricted to basic voice services.

Canada relies on market forces for the development of broadband, but in areas where the market has failed to deliver broadband Internet services on its own, the government has used targeted funding to support services in unserved areas. The formal evaluation of Canada's rural and northern development pilot project illustrates the value of evaluating such projects and publishing the lessons learned.

Canada: Evaluation of the Broadband for Rural and Northern Development Pilot

This Broadband Pilot Program was a CAN$105 million initiative between 2002 and 2007 to address the broadband gap between served and unserved communities. The objectives of the program included:

- Demonstrating the benefits of broadband in communities across Canada;
- Providing funding to unserved communities to prepare business plans for broadband services;
- Providing funding to unserved communities to help them implement broadband services that will assist in the areas of job creation, education, health, economic development, and governance;
- Creating opportunities for learning by sharing best practices among communities; and
- Creating new business opportunities, domestically and globally, for Canadian ICT companies.

Key findings of the evaluation included:

- CAN $4.2 million was invested in 154 projects, representing approximately 2,285 communities, to develop business plans that outlined their vision for the application of high-capacity Internet services.
- CAN $80.3 million was invested in the 63 projects, representing nearly 900 communities (including 142 First Nations reserves), in the form of a one-time investment in capital infrastructure implementation of broadband business plans.
- The number of communities yet to be served by broadband was reduced from 4,000 to 2,000.
- Ninety-three per cent of vendors and ninety-four per cent of project representatives indicated that without government assistance there is no business case for providing broadband services to rural and remote communities. If left to the market, only the most populated areas would be connected.
- The collaboration engendered by the project pushed up demand beyond what many providers and ISPs had expected.
- Broadband was extended to more communities than expected for two other reasons: when some communities heard that their neighbours were applying for the program they wanted to be included; and some vendors added more communities because network extension made it sensible to connect en-route communities as well as the project applicant communities.

The principal recommendation arising from the evaluation was that consideration be given to extending access to broadband services to a greater number of Canadian communities. It supported the existing "bottom up" community-based approach that appeared to have "a domino effect of increasing awareness of the benefits of broadband, which further increased the use of, and reliance on, broadband." Other recommendations focused on administrative improvements that could be considered in future programs.

Source: Industry Canada Audits and Evaluations: Formative Evaluation of the Broadband for Rural & Northern Development Pilot

The pilot program and its evaluation was followed up with the *Broadband Canada Program*, a three-year, CAN $225-million investment to bring faster internet to an additional 218,000 Canadians in underserved areas that ended in 2012.[43] The latest program under the *Economic Action Plan 2014* proposes to provide CAN $305 million over five years to extend and enhance access to high-speed broadband networks to a target speed of 5 megabits per second for up to an additional 280,000 Canadian households to achieve near universal access.[44]

The careful evaluation of pilot projects, whether as stand-alone broadband projects or within the framework of universal access programmes to ICTs helps to ensure that future public investments are well managed and it is good practice in any subsidy scheme to make monitoring requirements an integral part of the project design and management framework. The achievement of milestones, coverage targets and service obligations all require monitoring, to ensure cost-effective use of financial resources.

Best practices for effective management of funds are discussed in the OECD *Broadband Strategy Toolkit*.[45] The ITU/InfoDev *ICT Regulation Toolkit* also provides detailed guidance on practical matters including the monitoring and evaluation stages of the project.[46] Subsidy schemes used to support the adoption and take-up of broadband have the same need for transparency, accountability and efficiency as universal service funds, as reflected in a recent ITU study on that topic. [47]

Monitoring the adoption and use of broadband

While indicators of adoption and use are still being developed,[48] most countries have basic ICT statistics that can be used to support policy development and inform industry and users. On the demand side, many regulators already have some relevant information at hand including indicators of the number of customers measured by subscriptions, households, businesses and communities, where appropriate.[49] However, gaps in this information can be identified that need to be filled to provide a fuller understanding of user behaviour. For example, subscription information needs to be augmented with information about user choices of devices and patterns of use in order to be able to understand the real levels of access and affordability in a community and in order to estimate likely trends in demand.

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[43] Canadian programs have generally involved matching funding from other entities. Provincial programs and their relationship with federal government programs are reviewed in *Rajabiun, R., & Middleton, C. (2013). Rural Broadband Development in Canada's Provinces: An Overview of Policy Approaches. In W. Ashton & A. S. Carson (Eds.), [Special issue]. The Journal of Rural and Community Development, 8(2), 7-22.*

[44] Government of Canada Budget 2014

[45] OECD Broadband Strategy Toolkit, Section 4.4

[46] ITU/infoDev, ICT Regulation Toolkit - Universal Access and Service Module 4, Section 7 "Competing for UAS subsidies"

[47] ITU, Universal service funds and digital inclusion for all, September 2013

[48] For example, "adoption rate" can be defined as the number of people choosing to use a technology expressed as a fraction of the number to whom it is available. In this paper, unless the context indicates otherwise, "adoption" or "take-up" simply refers to the number of people using a technology, independent of availability.

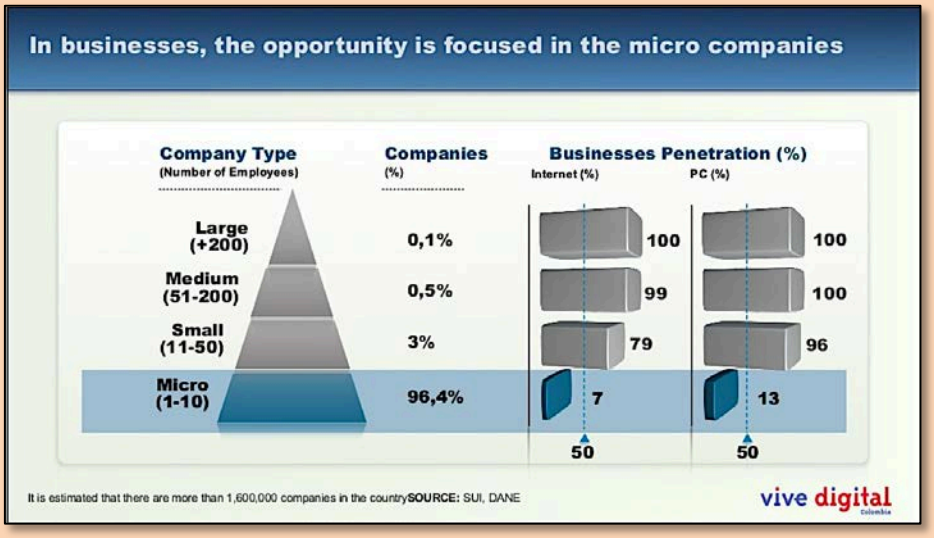
[49] It should be noted that in developing countries, the number of people taking advantage of "household" access could be much larger than in developed countries. Surveys of users may be the only way to measure these differences.

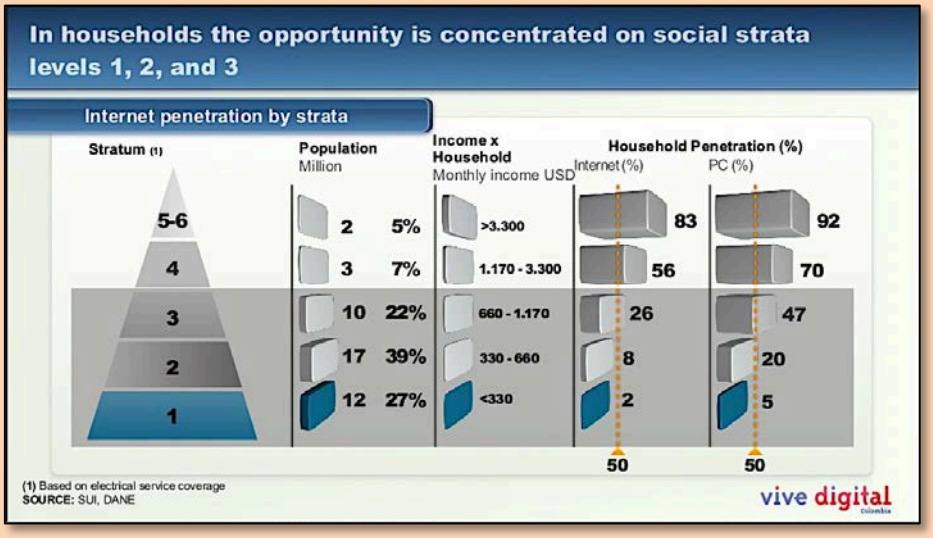
Additional information can be obtained from national statistical offices and from commissioned research, as will be seen in some of the examples to follow. National statistical offices rather than regulators may obtain general information about access to computers and the use of online services but ITU remains the leading international centre for aggregation of much of this information.

Some countries have very specific objectives in mind for the adoption and use of broadband that need to be supported by specialised information gathering. Colombia, for example, aims to extend broadband connectivity across the country's regions, and to stimulate adoption among the youth, within the poorest social groups, and by the country's smallest businesses. The policy is supported by efforts to measure the challenges, opportunities and progress in each of these areas.

Under Colombia's Digital Agenda, *Vive Digital*, work has already been undertaken to monitor the penetration and adoption of broadband by households at different levels of social strata and by small and micro businesses as shown in figure 10 using information sourced from the National Administrative Department of Statistics (DANE) and the Public Utility Superintendency (SUI).

Figure 10: Monitoring business and household penetration and adoption in Colombia





Source: Diego Molano Vega, Minister of Information and Communication Technologies, Colombia, Vive Digital - OECD Keynote, December 12, 2013

The *Vive Digital* Agenda also places high importance on the use of ICT in education and capitalizing on the proficiency of "digital natives" in the adoption of broadband. Low-cost services and customer premises equipment are offered to help bridge the social and regional gaps of Colombia by bringing ICTs to children

in rural and remote zones and by training teachers to be better acquainted with technology. According to an impact evaluation, the program reduces dropout rates, raises standardized test scores, and increases the probability that a child will enrol in higher education.[50]

At a regional level, the Economic Commission for Latin America and the Caribbean, has been working with collaborators including national statistical agencies, the Observatory for the Information Society in Latin America and the Caribbean (OSILAC), and the eLAC 2015 Indicators Commission to develop indicators and a statistical reference framework for assessing and monitoring the progress in the third phase of the *Plan of Action on the Information and Knowledge Society for Latin America and the Caribbean* (eLAC2015). This work aims to assess the region's progress compared with the rest of the developed world, allowing Governments and other stakeholders to draw their own conclusions about the effectiveness of their policies and the pace of progress in their respective countries.[51]

Canada provides another example of a country monitoring adoption patterns closely, with commissioned research providing feedback to the overall broadband policy agenda, with implications for the adjustment of broadband benchmarks and policy objectives.

Although Canada has relied primarily on private enterprise operators for the provision of broadband service with a variety of choices in terms of both price and quality, the Canadian regulator, the Radio-television and Telecommunications Commission in 2011 decided that an unregulated, aspirational minimum threshold of 5 Mbps downstream and 1 Mbps upstream should be considered the target for services to be available to all Canadians by 2015 and it stated that it would monitor progress towards this goal. At the same time it surveyed broadband access to provide a baseline against which to measure progress. It found that *availability* of 5 Mbps Internet service in small centres mainly kept pace with their larger counterparts, but availability declined rapidly for higher speed tiers. [52]

A follow-up report in 2013 found broadband availability to be 100% in urban centres and 83% in rural areas. [53] It also expanded the information on the *adoption and use* of broadband using survey-based information from the Media Technology Monitor (MTM) to monitor Canadians' choice and use of new and existing technologies. It found a complex and evolving picture with regard to the adoption of digital technologies, noting that in the use of digital media, product life cycles and consumer adoption patterns tended to move over time through a cycle of innovation, expansion and decline as shown in figure 11.

For example, *emerging* trends included online-only television viewing, *expanding* trends included possession of a smartphone, *maturing* trends included having a Wi-Fi network at home, and *declining* trends included listening to podcasts and subscribing to analogue cable services. This type of analysis demonstrates the value of considering consumer adoption and use of broadcast and online media in a fully "converged" manner. It also shows how changing patterns of adoption and use provide a feedback loop indicating changing demand for broadband capacity and availability, whether in terms of greater download capability or greater mobility. When broadband access can be wireless or wireline-based, multi-function consumer devices open up the range of consumer choices between streamed, broadcast and interactive services, with consumers able to engage with the digital world at the time and place of their choosing.

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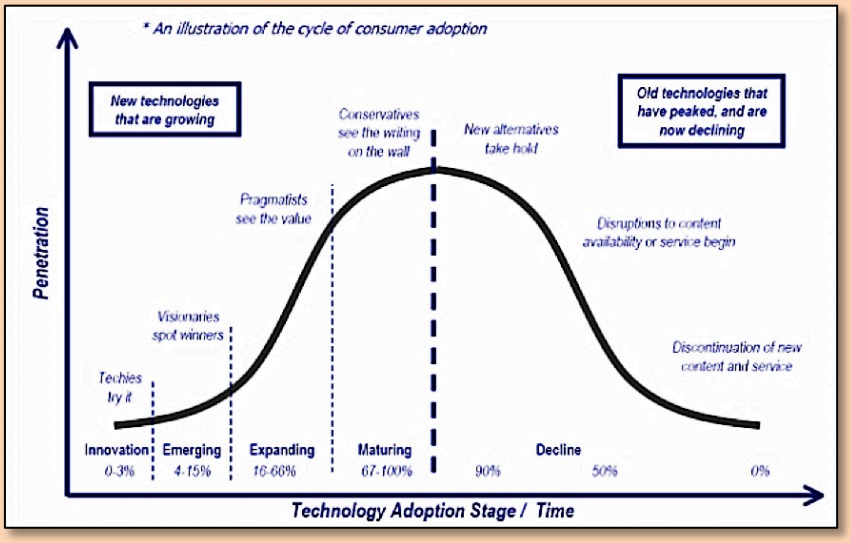
[50] Diego Molana Vega, Minister of Information and Communication Technologies of Colombia, "Colombia's Digital Agenda: Successes and the Challenges Ahead" in *The Global Information Technology Report 2013*, World Economic Forum

[51] Economic Commission for Latin America and the Caribbean, Monitoring of the Plan of Action eLAC2010: Advances and challenges of the information society in Latin America and the Caribbean, November 2010, page 9.

[52] CRTC Broadband Report November 2011, page 1 and 13

[53] CRTC *Communications Monitoring Report 2013: Broadband availability and adoption of digital technologies.* Data related to consumer behaviour was gathered primarily from contracted research and publicly available data rather than direct data collection. One of the primary data sources was the MTM Fall 2012 survey, which examined the media habits and technology usage of 8,000 Canadians 18 years of age and older.

Figure 11: Cycle of consumer adoption / product life cycle observed in Canada



Source: MTM 2012, from CRTC Communications Monitoring Report 2013

The Commission concluded that it needed to reconsider not only the availability of broadband Internet access service, but also the capacity requirements that must be met for participating in the digital environment, in the light of changing evidence about consumer behaviour. In its 2013-2016 Three-Year Plan, the Commission indicated that it would undertake a comprehensive review to determine what services (*e.g.*, voice, broadband) are required by all Canadians to fully participate in the digital economy.[54] Thus, as in the United States, monitoring of adoption and use of broadband provides an information base to support reconsideration of the benchmark objectives for broadband access.

Having seen examples of how countries are more closely monitoring adoption patterns, this section concludes with a brief review of some other key issues that may be measured in support of broadband adoption.

Affordability

Consumers are concerned about the price of broadband access, ahead of issues around service quality and choice. Users are sensitive to price, especially for a first purchase. Entry level pricing is the most important indicator of affordability, which regulators can measure locally, taking account of equipment as well as service costs. International comparability can then be established, for example to determine whether or not the Broadband Commission affordability target for basic fixed-broadband services at less than 5% of monthly gross national income per capita has been achieved.

Business adoption and feedback

Small business uptake of broadband is an important measure of adoption and a key building block for many e-services. Many countries already encourage and monitor adoption of broadband by micro, small and medium sized enterprises. Business users also provide a complementary source of feedback on broadband developments because they are early users of high-speed services and will quickly report problem such as market failings, service gaps, regional disadvantages, reliability and quality weaknesses, inflexible regulations and barriers to innovation. Their feedback to regulators should contribute to the overall assessment of the progress of broadband implementation.

[54] *CRTC Three-Year Plan 2013-2016*

Large users can also assist in monitoring the availability of skilled staff for both the demand and supply sides of the industry. Indeed, they may compete with broadband suppliers for talented staff and can provide important support for public-private partnerships that aim to build a specialised skills base for the broadband economy. In some cases, they may be willing participants in regional and community based partnerships to build skills at the local level – and can provide feedback on their progress and successes. Of course, informal assessments of human capacity and skills may need to be backed up by an actual survey of local conditions and resources - as was found in the Dominican Republic.[55]

Anchor institutions

In the United States, the importance of data gathering for broadband is demonstrated by the creation of the State Broadband Initiative (SBI)[56] as a competitive, merit-based matching grant program funded by the American Recovery and Reinvestment Act. The SBI is intended to increase broadband access and adoption through improved data collection, publicly accessible broadband maps, and statewide broadband planning. It is managed by the Department of Commerce through the National Telecommunications and Information Administration (NTIA). The National Broadband Map is one of the products of this initiative, providing a rich body of information not only on broadband availability, but also take-up by community anchor institutions as illustrated in figure 12.

Figure 12: Broadband take-up by community anchor institutions nationwide, USA

Community Anchor Institutions

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Institution	Total Number of Records	Subscribe to Broadband: Yes	No	Not Provided	Speeds Reported
Schools K through 12	131,522	74,379	793	56,350	70,468
University, College, other post-secondary	9,523	3,601	172	5,750	3,416
Libraries	22,558	14,816	444	7,298	13,393
Medical / Healthcare	59,305	12,888	1,227	45,190	11,376
Public Safety	56,034	12,881	3,062	40,091	8,864
Community Centers - Government support	39,173	25,075	1,144	12,954	21,915
Community Centers - Non-Government support	22,200	4,710	529	16,961	3,955

Source API Call

Source: National Broadband Map (http://www.broadbandmap.gov/summarize/nationwide)
Data provided by SBI grantees as at 30 June 2013

Digital literacy and inclusion

In 2011, the Broadband Commission noted that about 17% of the world's adults — 796 million people — still lacked basic literacy skills. Nearly two-thirds of these are women. The quality of education remains

[55] Edwin San Roman, Bringing Broadband Access to Rural Areas: A step- by- step approach for regulators, policy makers and universal access program administrators: The Experience of the Dominican Republic, ITU GSR 2009

[56] Formerly the State Broadband Data Development program.

very low in many countries and millions of children are emerging from primary school with reading, writing and numeracy skills that are far below expected levels. The state of literacy and digital literacy are fundamental issues for many countries.[57] The regulator may assist in dealing with these educational issues, but may not necessarily lead.

ITU's *Connect a School, Connect a Community* project[58] makes advice, training materials, applications and tools available so that these centres can also serve disadvantaged and vulnerable groups, including women and girls. It is important that school connectivity projects include methods to measure progress towards school connectivity, evaluate the results of Internet connectivity on basic literacy and advanced skills, and analyse the impact of broadband access on learning. Such reporting is important in order to ensure sustainability, particularly in the initial adoption stage.

In the Republic of Korea, digital literacy programs have targeted groups such as the elderly, farmers and housewives that might otherwise have been left behind. Similarly, the NTIA Broadband Adoption Toolkit shares best practices from broadband adoption and digital literacy projects in about 100 communities in the United States.[59] Both of these examples highlight the value of partnering with established community organisations that people know and trust to engage hard-to-reach populations and sharing information about their success.

Digital inclusion plans also need to monitor gender gaps[60] and access for people with disabilities – issues that appear in only a limited number of broadband plans as shown in figure 4. School and community-based projects can be important in dealing with these issues as well as providing information and education on cyber security and safety online. Programs such as these should to be monitored as important parts of the overall broadband plan.

Service quality and speed

As broadband use expands, service quality has become an increasing concern in some countries, particularly where advertised speeds greatly exceed the actual experience of users. An increasing number of regulators in places including Brazil, New Zealand, Pakistan, Poland, Singapore, Sri Lanka, the United Kingdom, the United States,[61] and Europe are moving to stricter measurement and reporting of fixed broadband service quality, starting with consumer information and in some cases moving to stronger measures. In Singapore, the IDA provides information to consumers on the performance of services as well as pricing in the form of interactive charts on its website.[62] Mobile service quality issues are more complex, but the FCC and Ofcom have work underway to measure mobile performance.

The European Commission found major discrepancies between advertised and actual speeds on fixed networks; on average European consumers received only 74% (more recently 75.6%) of the advertised headline speed. Consequently, regulators in the EU will be required to monitor quality of service and operators will be required to supply information on average speeds provided in normal and peak times as well as information on their data limits, and traffic management practices.[63]

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[57] Broadband Commission Broadband: A platform for progress June 2011, page 78

[58] Connect a School, Connect a Community

[59] NTIA Broadband Adoption Toolkit Shares Best Practices Across U.S. 2 May 2013

[60] Doubling Digital Opportunities: Enhancing the Inclusion of Women & Girls in the Information Society, A Report by the Broadband Commission Working Group on Broadband and Gender, September 2013

[61] In the United States, the *First Measuring Broadband America Report* identified ISPs that fell short of advertised speeds and a few months after the report was released, but the *Second Measuring Broadband America Report* found substantial improvement with consumers experiencing performance more closely aligned with what is advertised.

[62] http://www.ida.gov.sg/applications/rbs/chart.html

[63] European Commission, Commission adopts regulatory proposals for a Connected Continent 11 September 2013 and http://ec.europa.eu/digital-agenda/en/news/quality-broadband-services-eu-samknows-study-internet-speeds

In August 2013 the Australian Competition and Consumer Commission released a consultation paper on a proposal for monitoring fixed broadband performance. It reviewed international models and invited comments on an approach that would not report the experience of individual consumers, but it would show performance trends across different technologies, Internet service providers and regions.[64]

It seems likely that performance quality will be a prominent issue to be monitored as broadband becomes an increasingly indispensable part of social and economic development and the focus moves increasingly to key issues to be monitored in a fully integrated broadband environment.

Monitoring broadband integration

Is it possible to determine when a fully integrated broadband environment has been achieved? No single indicator is sufficient, but a number of indicators considered together may show that broadband has become a pervasive and indispensable part of social and economic life. For example, a regulator might consider that integration has been achieved when there is evidence of:

- ubiquitous availability of broadband connectivity,
- high levels of digital literacy,
- full coverage and utilisation of broadband among all key community and economic institutions,
- well advanced progress with digital inclusion, and
- universally affordable access.

A further indicator to consider is whether alternatives to online communication are becoming devalued, difficult or unavailable, increasing the cost and disadvantage of exclusion from broadband connectivity.

In the integration phase, pilot projects and community development programs give way to more mature and more fully connected eGovernment, eHealth and eEducation services. These areas, all seen as opportunities in the adoption phase, become close to essential facilities in the integration stage. A consequence for regulators is that they are obliged to give priority attention to monitoring and implementing measures to support this new level of reliance on broadband services including

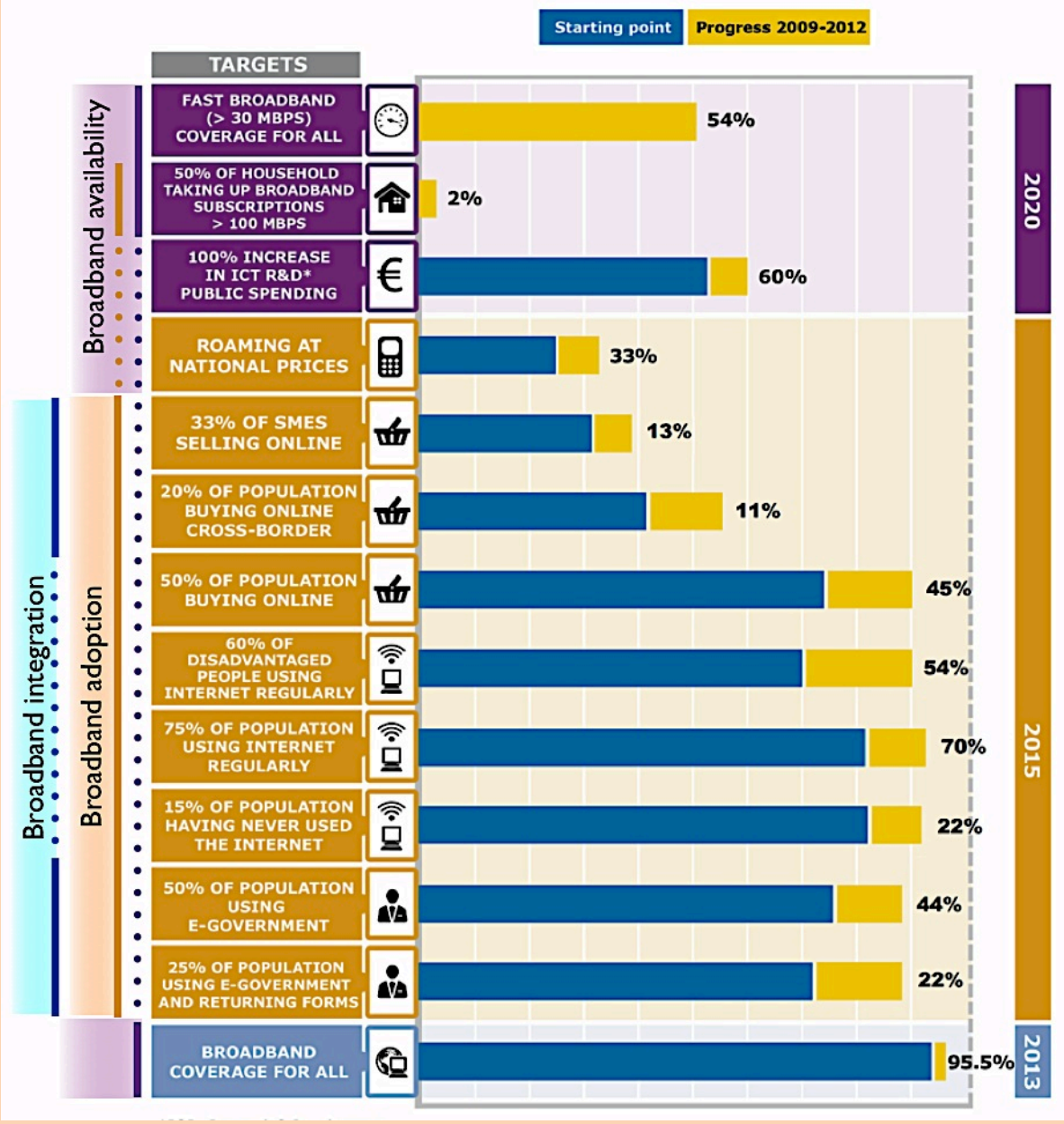
- the reliability, resilience and quality or broadband services,
- remaining gaps in digital inclusion and affordability, and
- security and safety online.

Europe's Digital Agenda forms part of the wider *Europe 2020* strategy for European Union growth in employment, productivity and social cohesion. The Digital Agenda also provides an example of the issues to be monitored in broadband plans that cover the gamut of issues from deployment of fast broadband and encouraging adoption by consumers and businesses, toward a more complete integration of broadband connectivity in social and economic life.

The Digital Agenda website maintained by the European Commission measures progress toward targets that have been set – with baseline data for each starting point shown in the Digital Agenda "dashboard" shown in figure 13. The website contains a wealth of other information including updates on work programs that contribute to each element of the digital agenda, the stages of work involved in the processes underway to overcome particular barriers, and information on how initiatives will work in practice.

[64] ACCC Broadband performance monitoring and reporting program

Figure 13: European Commission Digital Agenda



Source: European Commission, Digital Agenda Scoreboard 2012.
Sidebars on broadband "availability", "adoption" and "integration" added by the author.

Although ITU has already carried out work to measure the positive impact of broadband on wider economic activity it may be daunting to consider the expanded range of monitoring issues associated with the implementation of broadband plans when they become absorbed in wider agendas to advance national goals in areas such as improved government processes and performance, civic engagement, education, health, energy, research, development and innovation in the interest of broad social and economic progress. [65]

[65] Economic impact studies are brought together in Dr Raul L Katz The Impact of Broadband on the Economy: Research to Date and Policy Issues (ITU, April 2012)

Large business and government users will be among the first to provide feedback on any needs and deficiencies in broadband provision as their level of demand and dependence on high-speed connectivity expands. They also will be among the first to develop their own monitoring systems to assist in the management of increasingly complex, integrated and pervasive ICT networks that are central to their core business and heavily reliant on broadband connectivity.

Clearly, an ongoing process of monitoring and evaluation will be needed, and leadership will increasingly shift away from technology experts toward expert users as good practice models in each area of activity continue to develop.

The *National eHealth Strategy Toolkit* provides an important instance where fit-for-purpose data/telecommunications connectivity plays a supporting and essential role in the use and accessibility of information generated by advanced medical equipment. Monitoring the contribution of broadband finds a place in the wider landscape of monitoring costs, benefits and health outcomes.[66] As health administrators struggle with ever-expanding demands and costs, broadband-connected technologies offer scope for substantial savings and service improvements.

In the health sector, the "adoption" phase of broadband connectivity may appear as costly, although with long-term benefits; whereas in the "integration" phase it can become part of a larger ecosystem in which broadband enables multiple applications and uses. The *eHealth Toolkit* proposes a perspective for identifying short, medium and long-term approaches to be considered. This recognises the importance of demonstrating outcomes and benefits throughout the process of national strategy implementation, building and maintaining momentum and support for eHealth; and thereby improving the health of national populations.[67]

Some of the key points noted in this paper may be helpful in the ongoing dialogue with sectoral experts as the process of integration of high-speed broadband in wider social and economic life advances. In particular, it may be useful to recognise that short, medium and long term plans might need to reflect the phases of deployment, adoption and integration, with monitoring strategies tailored to each stage.

The benefits associated with the cost of deployment may not be fully realised until the adoption and use of broadband is taken up and new opportunities emerge in a more integrated broadband environment. Short term costs need to be weighed against long-term gains. Within each sector, sharing of information down to the local level, and closer attention to adoption patterns, areas of special need, and feedback loops can be helpful in developing a shared understanding of barriers, opportunities, priorities and appropriate benchmarks and objectives.

When broadband is fully integrated in society and the economy, attention turns to outcomes measured not only in terms of costs and savings, but also in terms of spill-over effects and overall gains in capability, efficiency, productivity, innovation and public welfare. New measures may need to be developed to monitor changes in people's behaviour and increased dependence on broadband-based services. Communications regulators will be well placed to assist their colleagues in other sectors as they work through these issues.

However, it would be wrong to focus solely on large business and government issues. Small business, covering a much larger proportion of the work force in most countries, also has an essential role in driving the uptake and use of broadband. The Australian Communications and Media Authority (ACMA) has therefore added some complementary and exploratory studies to its annual reporting on communications developments to include reports on topics such as Australian SMEs in the digital economy, which

[66] ITU and WHO National eHealth Strategy Toolkit 2012

[67] National eHealth Strategy Toolkit 2012, page v.

examined a range of issues including the intensity of online activity by small and medium sized enterprises, and also their exploration of new ways of doing business with online technology. [68]

ACMA has also found that Australian businesses are using mobile broadband to drive productivity, make faster decisions, improve product and service quality, and become more efficient and flexible. Its recent research report on the economic impacts of mobile broadband on the Australian economy, from 2006 to 2013 found that in 2013, mobile broadband led to an estimated increase in Australia's economic activity of AUD $33.8 billion. Of this, AUD $26.5 billion was attributed to time savings for businesses using mobile broadband.[69]

Studies such as these, and wider experience, continue to improve understanding of the way that broadband access is changing broader economic and social behaviour. The ways that people gather information, the way they work and relate to an expanding range of institutions, taking advantage of the opportunities for improved levels of capability, efficiency, participation and innovation are still being explored.[70]

All of this suggests that as dependence on broadband connectivity grows, it can be expected that regulators will continue efforts to monitor the availability, speed, affordability and reliability of broadband services and to overcome any remaining barriers to the adoption and effective use of high speed broadband connectivity.

4 Conclusions

A number of conclusions can be drawn from the research and analysis developed in this paper. When broadband plans are being developed and implemented, the following are recommended for consideration by regulators and policy coordination agencies as good practices:

- A monitoring and feedback framework should be considered to be a necessary part of any broadband plan. *Appendix A* provides an optional list of items for consideration.
- Consider ways of making the information widely available so that all stakeholders have the opportunity to make informed decisions about their own contributions to both the supply and use of broadband in an overall coordination framework.
- Consider ways to ensure that broadband indicators are in place to provide feedback on progress against targets for the expanded deployment and adoption of broadband services, with indicators that provide a basis for international comparisons.
- Consider appropriate indicators of broadband adoption and use that are relevant to local communities, groups and regions with special needs. Consider in particular ways to recognise and highlight innovation in the use and application of broadband and demonstrations of new capabilities enabled by broadband.
- Consider ways to ensure not only that outcomes are measured appropriately, but also that important process milestones are identified and progress reported in a transparent manner, for example on a public website.

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[68] ACMA *Communications report 2012–13* and *Report 1 – Australian SMEs in the digital economy*. ACMA has also published a series of brief "snapshot" reports on topics such as *Australians cut the cord: becoming mobile only, The connected business,* and *Home is where the work is: the digital worker*

[69] Two reports were commissioned by ACMA: The Centre for International Economics reported on *The economic impacts of mobile broadband on the Australian economy, from 2006 to 2013,* and Woolcott Research reported on *The business mobile communications usage and impact survey.* Both reports are accessible from the ACMA website at http://www.acma.gov.au/theACMA/engage-blogs/engage-blogs/Research-snapshots/The-mobile-business.

[70] See also: NTIA report explores how and why people connect to the Internet, 7 June 2013 and the work of the Institute for a Broadband-enabled Society.

- Consider ways to ensure that contracts, licences, projects and programs have built-in monitoring and feedback requirements to ensure that their reach, costs, benefits and outcomes can be measured, and to assist in identifying implementation problems that may require correction.
- Consider the need to adjust measures over time as priorities shift from deployment of services, to their adoption and use, recognising that when broadband is fully integrated in social and economic life it may shift from being seen as a *cost* and be recognised an essential underpinning and a means of *savings* across wider social and economic sectors.
- Consider ways to collaborate beyond the communications sector to monitor developments with a view to measuring short, medium and long-term outcomes in sectors such as health and education where improvements in capability as well as reach and efficiency, may be achieved in cost-effective ways after initial hurdles associated with deployment, adoption and capacity-building have been overcome.
- Consider ways to contribute and participate in the ongoing discussion of broadband impacts on social and economic life with a view, where necessary, to reviewing established benchmarks for broadband capacity as demand and usage continues to develop.

* * *

Appendix: A monitoring checklist for implementation of a broadband plan

For every country, the targets to be achieved will reflect local circumstances. Process milestones will also be unique to each country, depending on the regulatory, contractual, economic and other constraints that apply. The following checklist is therefore a guide only to the elements to be considered in each country when considering their own information gaps and ways to overcome them.[71] The broad categories set out below are intended to assist the identification of specific nationally relevant objectives and actions.

Checklist of optional elements to be considered in a monitoring framework for implementation of a broadband plan

Objectives and actions	Target date	Status
Enabling framework for broadband development		
Enabling measures		
• Broadband plan in place		
• Key stakeholders consulted		
• Coordination framework in place		
• Cross-sectoral support for key strategies & objectives		
• Monitoring and evaluation process established		
• Targets and process milestones established		
• Reporting in place for process milestones and progress		
• Reporting in place for achievement of targets and outcomes		
• Taxes, duties, fees minimised to support the broadband plan		
• Affordable user equipment		
Regulatory framework		
• Regulatory scope is sufficient to support the broadband plan		
• Regulatory capacity is built up and maintained		
• Education and training priorities identified and implemented		
• Licensing to facilitate broadband service expansion		
• Unified and technology-neutral licensing framework established		
• New model licences issued		
• Licence conditions in place and monitored		
• Spectrum arrangements support broadband rollout		
• Policy framework for wireless broadband access established		
• Timetable established for provision of spectrum for broadband		
• Services cleared to enable wireless broadband access		
• Wireless broadband access spectrum allocated and assigned for use		

[71] The form of this checklist is modelled on the example provided by the Victorian Government's ICT Strategy Action Checklist which is available online at http://www.digital.vic.gov.au/status/. In some cases that checklist uses simple graphics as well as text to indicate progress through the stages of a project as shown in figure 6.

Objectives and actions	Target date	Status
• Civil works facilitation		
• Multiple approvals streamlined		
• Access to key requisites (poles, roofs, towers etc.,) facilitated		
• Sharing and interconnection measures facilitated		
• Cost-based interconnection facilitated		
• Infrastructure sharing permitted/facilitated		
• Gateway access facilitated		
• Open access on commercial terms established		
• Diversity of access established		
• Backbone coordination facilitated		
• Consultations with stakeholders undertaken		
• Framework for cooperation agreed		
Broadband deployment and availability		
Broadband indicators in place		
• Telecommunications/broadband indicators established		
• Regulator reporting from operators in place		
• Analysis capability established		
• Broadband availability indicators by market segment		
• Central business districts		
• Urban areas		
• Rural and remote areas (*mapping may be required*)		
• Fixed and wireless technologies		
• Basic and advanced speeds		
• Interactive or published map of broadband availability		
• Price of basic and advanced services		
• Waiting times for service supply and restoration		
• Technology and devices in use		
• Updated to reflect changing usage and adoption patterns		
• Key barriers identified		
• Process to deal with identified barriers established and reported		
• Process milestones identified and reported		
Broadband competition monitoring		
• Infrastructure and service-based competition measured		
• Number of shared and unbundled lines reported		
• Maps of competing service availability		
• Surveys of uptake of competing retail services		
• Opportunities for co-located facilities identified and made available		

Objectives and actions	Target date	Status
Open access wholesale services		
• Access and deployment targets set and reported		
• Procedures in place to deal with delays and shortfalls		
Broadband adoption and use		
Key indicators		
• Broadband adoption - subscriptions/take-up		
• Technology platform and speed		
• Demographic categories including target social and age groups		
• Level of usage		
• Technology and service preferences and usage		
• Volume of data traffic (usually download volumes)		
• Uptake of broadband offerings by speed of download		
• Take-up by small and medium sized businesses surveyed		
• Number of small & medium sized businesses with online presence		
• Number of government agencies with online presence		
• Speed and capacity benchmarks updated to reflect usage trends		
Barriers to adoption and effective use		
• Broadband affordability		
• Cost of entry-level access as a percentage of income		
• Indicators of affordability by demographic sub groups		
• Indicators of take-up of subsidised terminal equipment		
• Broadband service quality		
• Service quality checks in place		
• Information published on measured service speed and latency		
• Comparison of advertised and experienced service published		
• Poor digital literacy		
• Skill levels surveyed and skill gaps identified		
• Training programs completed		
• Number of graduates of training programs		
• Barriers to digital inclusion		
• Survey gender participation rates		
• Measure uptake of services by people with disabilities		
• Other potential barriers		
• Level of interest and community concerns		
• Periodic /local surveys to identify perceptions of potential users		

Objectives and actions	Target date	Status
Outcomes for adoption and digital inclusion		
• Changing patterns of device and service usage monitored over time		
• Monitoring of target groups – by status, age, gender or disadvantage		
• Usage innovations identified and shared with other stakeholders		
• Educational and health outcomes monitored and shared		
Broadband integration		
Key indicators		
• New and emerging measures of		
• Technology engagement		
• Technology dependence		
• Intensity of use		
• Use of e-commerce		
• Use of e-government services		
• High speed broadband take-up		
• Cost and speed		
• Choice and usage		
• High speed broadband access		
• Number of competing suppliers		
• Coverage by competing suppliers		
Institutional synergies		
• Broadband integration in business practice		
• Volume of online marketing, sales and transactions		
• Extent of online recruiting, training and other business systems		
• Short, medium and long-term strategies in place for		
• Broadband integration in e-government agenda		
• Broadband integration in health agenda		
• Broadband integration in education agenda		
• Broadband integration in public safety agenda		
• Qualitative reports of increased capability and innovation		
• Studies of changing behaviour and practices		
• Consumer behaviour		
• Worker participation		
• Civic engagement		

Objectives and actions	Target date	Status
Project management and monitoring		
Subsidised deployment projects and programs		
• Transparent monitoring of tender procedures and outcomes		
• Process milestones identified and reported		
• Reporting responsibility clearly assigned in contracts		
• Targets established with regular progress reporting requirements		
• Coverage commitments mapped and progress reported		
• Transparent monitoring of progress against targets		
• Independent evaluation of project outcomes in place		
Subsidised adoption projects and programs		
• Transparent monitoring of tender procedures and outcomes		
• Reporting responsibility clearly assigned in contracts		
• Qualitative reporting on demand promotion projects:		
• Demand aggregation		
• Community anchor tenants		
• Government anchor tenants		
• Independent evaluation of subsidised projects and outcomes		
• Cost/benefit reporting for ongoing subsidised programs		

List of Abbreviations

ACMA	Australian Communications and Media Authority
BT	British Telecom
DSL	Digital subscriber line
CFH	Crown Fibre Holdings
CRTC	Canadian Radio-television and Telecommunications Commission
DANE	National Administrative Department of Statistics
eLAC	Plan of Action on the Information & Knowledge Society for Latin America & the Caribbean
FCC	Federal Communications Commission
GDP	Gross Domestic Product
ICT	Information and communication technology
IDA	Infocomm Development Authority
ITU	International Telecommunication Union
KPI	Key performance indicator
MDGs	Millennium Development Goals
MTM	Media Technology Monitor
NBN	National Broadband Network
NTIA	National Telecommunications and Information Agency
OECD	Organisation for Economic Co-operation and Development
Ofcom	Office of Communications
OSILAC	Observatory for the Information Society in Latin America and the Caribbean
OTT	Over the top
PPPs	Public-private partnerships
PSTN	Public switched telephone network
PWDs	People with disabilities
RBI	Rural Broadband Initiative
ROI	Return on investment
SBI	State Broadband Initiative
SME	Small and medium-sized enterprise
SUI	Public Utility Superintendency
UFB	Ultra-Fast broadband
UKE	Office of Electronic Communications
UNESCO	United Nations Educational Scientific and Cultural Organization
USF	Universal service fund
USO	Universal service obligation
WHO	World Health Organisation
WSIS	World Summit on the Information Society