TRENDS IN TELECOMMUNICATION reform 2015

GETTING READY FOR THE DIGITAL ECONOMY

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Trends in Telecommunication Reform 2015

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These contributions, together with the support from ICT ministries and regulators, and others who have provided data and background material, are gratefully acknowledged. Without their support, a report of this nature would be impossible.

Foreword

We are now entering a new era of communications. The future of the digital world is happening now. ITU stands fully prepared to support its membership to lead and open the door to a wealth of possibilities. I am pleased to present the 15th annual edition of *Trends in Telecommunication Reform*. This year's *Trends* report seeks to advance the global discussion of ICTs by focusing on how the benefits of an increasingly digital world can best be made available to users around the world in a way that gives users access to the most advanced services, provides businesses with appropriate incentives for innovation and ensures that policy-makers have the right tools to evaluate how well policies fostering digital inclusion are being implemented. Thus, the theme of this year's *Trends* report is: "Getting ready for the digital economy."

But are we ready? As broadband services become more widespread around the world, and as new applications and services are developed to serve new needs and challenge existing business models, the issues confronting ICT regulators and policy-makers are becoming more complex. Today, services can be provided by a variety of competitors irrespective of location—some may be local, but others may provide services from beyond a country's borders. As a result, new or updated regulatory approaches will be needed to ensure not only that innovation continues to flourish, but that consumers—and their data—remain protected. Although each country is unique, there are common lessons that can be learned.

To support policy-makers and regulators in getting ready for an increasingly digital society and economy, this *Trends* report analyses how the changes that are taking place in the digital ecosystem are impacting both individual consumers and businesses and society at large. It explores the implications of these changes for national ICT policy and legal/regulatory frameworks, and discusses how policy-makers and regulators can address the

new challenges raised by the digital economy in a smart, efficient and effective way.

The report addresses range of issues that span the full range of ICT policy-making, and delves into some important, but challenging, questions. As ICT networks and services constitute the bedrock of the digital economy, why is competition important and how can barriers to competition be reduced? How can spectrum policy be updated to balance the growing demand for broadband spectrum with increasingly crowded spectrum allocations; can changes to licensing and more spectrum sharing help? How can the power of Big Data best be harnessed, while ensuring that appropriate regulations exist to protect consumers and their data? What can policy-makers, regulators and industry do to ensure that digital consumers are protected? How can the data that the digital ecosystem now produces in vast quantities impact business models and what implications does this have for the digital economy overall? Finally, how can the implementation of broadband plans and strategies be appropriately monitored? How to gauge success and identify areas for improvement? To answer those questions, this edition draws up from discussion papers presented at the ITU Global Symposium for Regulators, held in 2014, in Bahrain.

The International Telecommunication Union is dedicated to helping regulators and policy-makers around the world navigate the

challenges posed by an increasingly digital world. As administrations seek to develop policies and regulatory frameworks that will address these emerging issues, we hope that the research, analysis and insights contained in this edition of the *Trends* report will provide useful guidance as policy-makers seek to harness the benefits of a digital economy.

The world has enough resources to provide a good quality of life for everyone. We need to get better organized and move a lot faster. We are building today the smart society of tomorrow and we need to do it right. I am confident that by bringing together a diverse group of stakeholders to share knowledge and experiences, ITU can help countries develop the most effective, informed and smart policies promoting digital inclusion and the advancement of ICTs to achieve sustainable economic and social development goals.

Brahima Sanou
Director
Telecommunication Development Bureau

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Executive Summary

Introduction

To assist policy makers and regulators in getting ready for the digital economy, this edition of Trends provides an analysis of the changing business and consumers behaviours led by technological innovation taking place in the digital ecosystem. It further provides an understanding on how these changes will affect national ICT policy and regulatory frameworks and identifies measures policy makers and regulators can take to be prepared to respond efficiently to the new challenges raised by the digital economy.

Chapter one examines key market and regulatory trends around the world and introduces a new analytical tool developed by ITU, the ICT Regulatory Tracker.

Chapter two examines ways to reduce barriers to competition and offers practical case-study examples of several approaches to devise a policy and regulatory framework to promote competition and consumer choice.

Chapter three looks at ways to accommodate broadband spectrum expansion through new modes of sharing and innovations in licensing.

Chapter four examines what Big Data is, looking at where ICT regulators, policy makers and other public authorities, have set or should set some boundaries.

Chapter five reviews a number of cross-cutting regulatory issues that policy-makers, regulators and industry should address to ensure that digital consumers are protected.

Chapter six provides an analysis of the economic influence of data and their impact on business models.

Chapter seven reviews the principles of performance monitoring, examines the increasingly broad scope of broadband plans and discusses how their implementation can be monitored.

Chapter eight draws overall conclusions.

Chapter 1: Market and regulatory trends in the ICT sector

Since the last edition of Trends, the information and communications technology (ICT) sector has continued its remarkable transformation. The growing adoption of broadband-enabled mobile devices has made access to the digital world more ubiquitous and pervasive. Technology is moving fast, transforming lifestyles and rendering old business models obsolete. The ICT industry has moved from distinct infrastructure platforms and connected devices to an ecosystem of computing – the cloud – which changes the traditional rules of the game. The cloud is enabling new innovations across the economy, at all levels, for everyone. Everything becomes a computing device, a connected device – be it a car, a fridge, or a pair of glasses. This new dimension of connectivity opens the way to massive, unlimited possibilities. Apps and m-services are empowering citizens to engage in all aspects of life irrespective of time, distance and location. However, disparities remain between those who have access to the new world of digital opportunities and those who do not, calling for continuous efforts to reduce costs and accelerate network and service deployments to achieve a truly inclusive digital society.

On the flip side, the digital economy has clearly raised many challenges that require increased attention from a regulatory perspective. Consumers are confronted with new issues brought about by the greater choice of devices, online services and applications. Identifying pro-active policy and regulatory measures in addition to co-regulatory and self-regulatory solutions and initiatives geared towards educating and empowering consumers is essential to protect the rights of all users in an open, transparent and inclusive digital world. Regulators participating in the 2014 ITU Global Symposium for Regulators (GSR-14) have identified and endorsed a set of regulatory best practice guidelines to protect consumer

interests, while also ensuring a level-playing field for traditional and new market players by fostering a light touch regulatory approach.

The interaction of the ICT sector for stimulating growth in the digital economy alongside other sectors needs to be understood and, wherever possible, managed by policy and regulatory frameworks of a new kind. To empower regulators and policy makers to do so, ITU has developed the ICT Regulatory Tracker, a new evidence-based analytical tool to help pinpoint the strengths and weaknesses of regulatory interventions. Analysis based on the Tracker clearly suggests that growth in services has happened most rapidly where regulatory enablers have been put in place to leverage latest technologies and innovations. In a nutshell, consistent, forward-looking and well-enforced, fourth-generation regulation generally provides for a vibrant market and win-win opportunities for both service providers and consumers.

The choice of regulatory intervention appears to have an equally strong impact on stirring up market growth. More precisely, the ITU Regulatory Tracker has shown that the combination of a handful of regulatory measures is closely associated with a catalytic effect on market take-up. With respect to mobile-broadband penetration, countries with a broadband plan, competition in both the mobile sector and international gateways, infrastructure sharing, mobile number portability and band migration, systematically outperform countries lacking some or all of those regulatory settings. Fixed broadband markets seem to have their "winning formula", too. The top-five measures on record are a Broadband Plan, open competition in wireline broadband technologies, an advanced licensing framework (featuring either unified licenses or a general authorization regime) combined with an infrastructure sharing policy and provisions for fixed number portability.

New econometric research by ITU further suggests that a 10 per cent increase in the ICT Regulatory Tracker score (corresponding to an incremental enhancement of regulatory frameworks) is associated with an increase of respectively 7.7 per cent in fixed-broadband penetration and 2.3 per cent in mobile-cellular penetration over the period 2008-2013. This evidence provides new grounds for informed policy-making and better targeted regulatory intervention.

Chapter 2: Why Competition Matters and How to Foster It in the Dynamic ICT Sector

The ICT sector has been rapidly evolving over the last few decades, creating an emerging broadband-centric environment that has presented regulators with varying and complex challenges. While traditional competition issues persist, new obstacles deriving from the entry of new entrants with new business models and alternative costs structures, coupled with the convergence of services and a rapid increase in the flow of data across the globe, have placed a tremendous burden on old revenue streams and long-standing regulatory regimes. Consequently, regulators and policymakers have been forced to adapt to reduce barriers to competition and protect consumer interests. This paper focuses on these concerns and offers practical case-study examples of several approaches regulators and policymakers have taken to devise a framework to promote competition and consumer choice.

To protect and promote competition in this new world, regulators and policymakers have adopted key reform efforts to address the various challenges. For one, liberalized licensing measures have created a more streamlined process for new competitors to enter the market. To help ease market entry, some countries have imposed access obligations requiring operators with significant marker power (SMP) to grant competitors access to their network elements at cost-based rates and on non-discriminatory terms. Other countries are creating wholesale broadband networks to supply backbone or even access services to retail service providers.

As countries seek to expand competition and extend networks to areas that are unserved, or underserved, approaches that require competing companies to share basic infrastructure are being adopted. However, regulators are finding that the benefits of faster deployment and lower costs can outweigh the risks of potential collusion or other anti-competitive concerns. Spectrum sharing goes a step further by combining

sharing at the access network layer with the sharing of dedicated frequencies.

As convergence has changed the way services are developed and delivered, net neutrality—the idea that all traffic on the Internet should be treated equally—has emerged as an important issue. Proponents of net neutrality are concerned that large access providers will discriminate against certain providers (i.e., those that compete with the provider's own service), or that they will prioritize some traffic or services (their own or those willing to pay more); thus skewing competition. The access providers argue that they have to be able to manage traffic to ensure network security and avoid congestion. To address such concerns as well as other rising challenges, some countries have begun to reform their regulatory approach.

The competitive landscape has undoubtedly become more complex over the last several years. With advancing technology and changing consumer demands, competition issues have only become more important. In an effort to address these changes, policymakers and regulators are engaged in various efforts to ensure competition flourishes and consumers are protected. With data trends continuing to point to substantial increases in usage and traffic, it is critical that consumer protection and competition remain at the forefront of any future regulatory changes.

Chapter 3: New Frontiers in Spectrum Licensing New Frontiers in Spectrum Licensing

Spectrum managers in countries around the globe today face strong pressure to free up more spectrum for broadband wireless network access. Prompted by a sharp and accelerating rise in wireless broadband subscriptions in many countries, 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). This chapter looks at the exploration, now under way in some countries, of ways to accommodate broadband spectrum expansion through new modes of sharing and innovations in licensing, without compromising incumbent spectrum uses.

There are several legacy methods of spectrum sharing, which can be described along the three-dimensional axes of frequency, time and geography. A band can be divided into a new channel plan, accommodating a new use while still protecting the incumbents. Additionally, new users can transmit during time periods when the incumbent is not actively using the spectrum. In some countries, regulators now allow licence holders to subdivide and trade portions of their spectrum, most often in terms of geographic areas, but also potentially for sub-bands of spectrum. In theory, this gives operators greater flexibility to either use or trade their spectrum rights, but regulators often find trading to be difficult to implement and complex in terms of ongoing oversight and regulation.

Meanwhile, new technologies are being developed to help augment these legacy sharing methods. "Smart" antenna technologies help to focus and sharpen the directionality of transmissions, improving conditions for sharing. Small cells can be used to generate greater frequency re-use, multiplying the use of a particular spectrum band to allow greater capacity and access in congested areas. Databases have been developed to incorporate geo-location capabilities, along with more static technical data, allowing new users to share spectrum by using unoccupied channels or frequencies in geographic areas where incumbents are present.

Greater demand for sharing, coupled with these technology enablers, is breeding experimentation in new, often hybrid, ways to license shared spectrum bands. One technique for sharing is the hybrid or "heterogeneous" use of licensed operator networks, combined with unlicensed (e.g., Wi-Fi) spectrum use. Known as "operator off-loading," this technique allows cellular network operators to direct data traffic from consumers onto small cells – even directly to the Internet via unlicensed RLANs – to avoid over-burdening their macro-cell networks in high-data-use areas.

Another emerging sharing technique involves the use of databases. Such databases are empowering trials and driving the development of rules in some countries for "TV white spaces," which allow unlicensed broadband services to operate in unoccupied spectrum in the UHF television bands (694-864 MHz). Several countries – such as Kenya and South Africa – have staged trials of TV white spaces operations, while other countries – such as the United States and United Kingdom – are developing TV white space regulations.

Cellular network operators in Europe and the United States are developing the concept of "licensed shared access" (LSA), a licensing framework that gives operators "priority access" to spectrum shared with incumbent users (perhaps government spectrum users). There would be a managed, or coordinated sharing scenario – perhaps using a database approach similar to those used for white spaces – that would provide a certain quality-of-service for the priority licensees, thus providing regulatory stability and incentives for investment that are generally not present in the licence-exempt, "swim-at-your-own-risk" model.

Chapter 4: Big Data - Opportunity or Threat?

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.

Big Data obviously is closely connected to our ability to gather, analyze, and store data easily and at a relatively low cost. But Big Data's likely impact will be felt beyond the economy; it affects how societies make sense of the world, and decide important policy challenges; and as you will read, it is having a profound impact on innovation.

The intent of this chapter is to offer a foundation; showing what Big Data is, explaining its recent history, and looking at where ICT regulators, policy makers and other authorities, such as competition authorities or data protection authorities have set or should set some boundaries. It examines the ways in which commercial entities collect, analyze and store data, that can be summarized in eight general principles. It utilizes the diversity in the practicalities and uses of Big Data to increase awareness of the benefits and the risks; placing it in a context that allows for understanding of where the industry has been and where it could be going. For regulators, the question is: what can, or should, be done to carry out their responsibilities? Recognizing that no two countries or economies share a common or identical governance structure to oversee the technology, media or other societal sectors, this analysis treats them having a similar mandate.

The chapter is divided into four main parts: first 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 the reader is then 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.

The concluding section sheds the light on establishing policy and the rules that will encourage the further use and benefits derived from Big Data, to set the proper frameworks to prevent societal or individual abuses.

Chapter 5: Consumer protection in the online world

One of the most important aspects of ensuring that the potential of the emerging digital world is realized is ensuring that the end users and consumers that use the Internet every day can do so safely and securely. Policy-makers and regulators have an important role to play in this regard, both in terms of setting rules that will protect consumers, as well as educating consumers on how to safely get the most out of their online experiences. In this regard, it is important to note that many of the emerging actors in the online world are either unregulated or only lightly regulated. As more and more social and economic activity is carried out online, however, this may have to change. This chapter examines the various activities that people engage in online, discusses the various regulatory issues that are involved in protecting online users and describes some of the efforts that have

recently been made to address the conduct of the new market players that are gaining importance in the e-commerce ecosystem.

As policy-makers and regulators seek to drive broadband adoption, they have rightly concluded that online consumer protection will be an important part of ensuring trust and security in the online world. From this perspective, three main trends are important to keep in mind. First, and most obviously, the use of online services is growing rapidly in both developed and developing countries, although developed countries still have more users. This growth is also broad-based, as digital consumers are increasingly using online services for a variety of purposes, including simply searching for information, shopping online, downloading and streaming music and video, playing games and using other (mobile) apps, keeping up with friends on social media and often storing information in the cloud. For each of these activities, users have particular needs or concerns that policy-makers may have to address—in addition to the cross-cutting issue of how the data consumers generate will be used. Second, the online world tends to be dominated by only a handful of large players (e.g., Google, Microsoft and Facebook), each of which controls a large part of their individual markets. Finally, advertising and the collection of user data is driving many of the business models that are being developed for the online world. Each of these trends will put pressure on governments to act to protect their users.

Given these considerations, this chapter identifies a number of cross-cutting regulatory issues that policy-makers, regulators and industry should address to ensure that digital consumers are protected.

Chapter 6: The economic influence of data and their impact on business models

An increasing number of devices that collect and transmit data have been improving access to information. New data transport, storage and analysis procedures have been enabling more and more businesses to utilize data in their business models. This indicates a trend towards data collection and use becoming a new driver of economic growth. In light of this development, this chapter first traces the evolution of business models built around data, and discusses the evidence for a sustained structural change in our markets; leading to a data-driven economy that policy-makers and regulators need to be alert to. To focus the analysis, a structural approach to analyze this emerging economy and its development is devised: the data value circle. When the data value circle is applied to analyze the market size and prospects for each of its parts, three important characteristics of the data-driven economy emerge. First and foremost, the analysis underlines the fact that data's economic influence stretches 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, and thus markets should be monitored by policy-makers and regulators, especially since; third, the analysis indicates that it is still uncertain which players will emerge as the most powerful.

This last finding merits a closer investigation of business models, strategic options and emerging challenges in the data-driven economy. Thus, this chapter 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; and (5) video streaming. From these five models, the strategic options of market players and emerging challenges for all stakeholders are identified. Finally, the chapter sketches potential avenues for policy-makers and regulators in response to the following challenges: addressing dominance, monitoring partnerships, protecting consumers and establishing a global approach.

Chapter 7: Monitoring the Implementation of Broadband Plans and Strategies

Measurable information about the supply and use of broadband services provides a basis for judging whether broadband plans and digital strategies are achieving the objectives that have been set.

This chapter reviews the principles of performance monitoring, examines the increasingly broad scope of broadband plans and discusses how the implementation of broadband plans and strategies can be

monitored. 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 chapter 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 that are explored in the chapter.

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.

Chapter 8: conclusion

This chapter brings together the important issues that are addressed in this edition of *Trends*. Those issues will have to be addressed if the full benefits of the emerging digital world are to be realized.

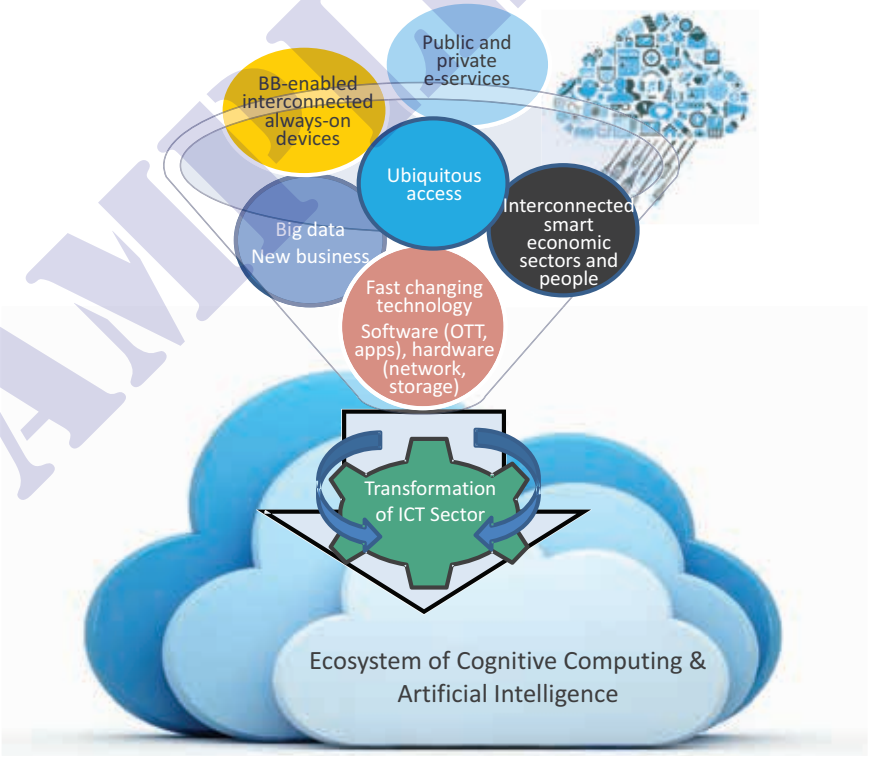
1 Market and regulatory trends in the ICT sector

Authors: Youlia Lozanova and Nancy Sundberg (BDT/ITU); with contributions from Phillippa Biggs (ITU) and Chelsea Mori

This chapter provides an overview of ICT market trends and starts by exploring cutting edge technologies in order to provide an overview of where the sector is headed. These trends are increasingly global and impact both developed and developing countries. The Chapter is intended to help stakeholders, and in particular ICT regulators keep abreast of the latest developments and prepare for the digital society. It explores evidence that shows how policies and regulation may impact ICT services uptake and introduces new tools developed by ITU.

1.1 ICT market trends

Since the last edition of Trends, the ICT sector has continued its remarkable transformation, and its impact on society and economic and social development has become even more obvious. The growing adoption of broadband-enabled mobile devices has made access to the digital world more ubiquitous and pervasive. Technology is moving fast, transforming lifestyles and rendering old business models obsolete. The ICT industry has moved from distinct infrastructure platforms and connected devices to an interconnected ecosystem of computing – the cloud – which changes the traditional rules of the game. The cloud is enabling new innovations across society and the economy, at all levels, for everyone. Everything becomes a computing device, a connected device – be it a car, a fridge, or a pair of glasses. This new dimension of connectivity opens the way to massive, unlimited possibilities. Apps and m-services are empowering citizens to innovate and engage in all aspects of life irrespective of time, distance and location. Figure XX tries to capture the transformation of the ICT sector:



In this digital environment, huge amounts of data are created every minute. The explosive growth of data combined with the demand for data – the new oil of the economy

as some have called it – is reshaping the ICT industry opening up a wealth of new opportunities to innovate, do things better, faster, more widely or in a completely new way. For consumers, a new set of interactions is ruling user experiences and creating new efficiencies. New opportunities are arising for governments, business players, and consumers alike, with new challenges for ICT regulators given the additional challenges for infrastructure development. How do we unleash these opportunities? New skills, new thinking, and a different set of policy tools are part of the strategy needed to leverage the digital transformation and enable innovation and investment.

Over recent years, technological advances have democratized ICTs moving from a time where mainframes and PCs were the exclusive use of a group of qualified professionals to a society where many more people can use multiple screens and devices; where cars and objects can be connected and communicate; where cities are increasingly becoming smart; and where cognitive computing and artificial intelligence will soon be turned into full-fledged reality (see Figure 1.1). Technology has moved from being uncommon and difficult to use to being pervasive, intuitive, and more user-friendly. Digitization has accelerated technological developments over the last two decades.

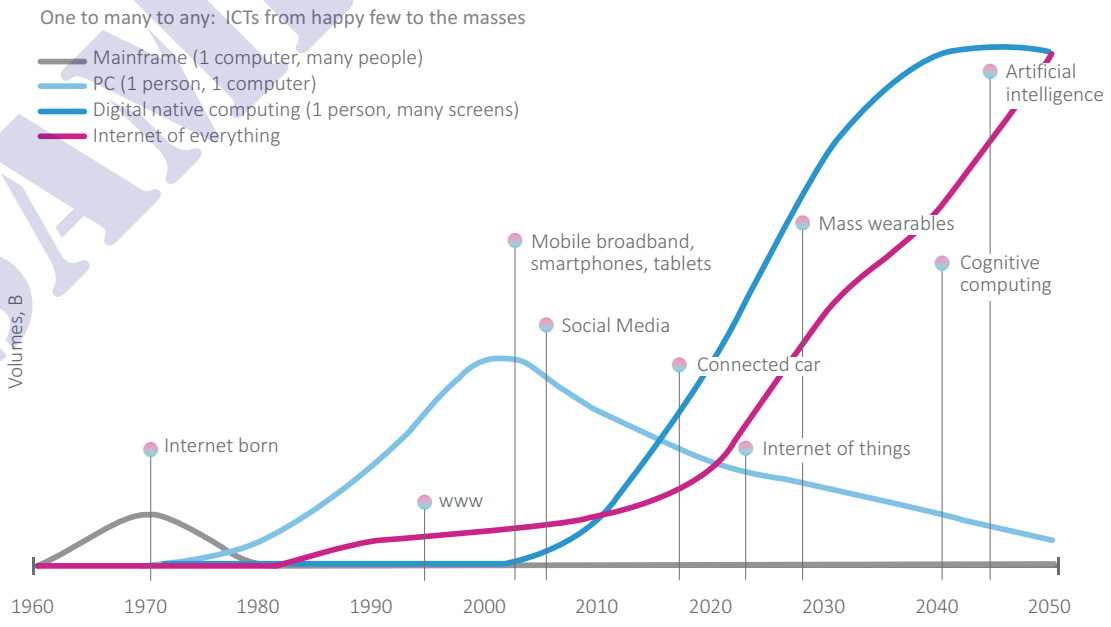
The Internet, including through the cloud, has intimately invaded all spheres of people's lives, changing economic, social and cultural patterns, and has become a fundamental enabler of progress across the economy. What will be next? Some of the exciting future innovations such as wearables and artificial intelligence are nascent, and have yet to prove their full potential. Other, even more revolutionary innovations are probably not even on today's radars yet. Shaping the history of the digital future needs an understanding of past and present phenomena, as past innovations are destroyed, sometimes to be reinvented in a new way to fulfil people's continuing need to communicate, create and innovate.

However, technology cannot be examined in isolation, but needs to be considered in a broader context, where socio-economic aspects of access and affordability are brought into play.

Uptake in ICT services

Accessing the digital world is no longer the privilege of a few. But disparities remain between those who have access and those

Figure 1.1: History of the future



Source: ITU.

who do not, calling for continuous efforts to reduce costs and accelerate network and service deployments to achieve a truly inclusive digital society.

Twenty years ago, only one per cent of the global population had a mobile cellular subscription, and 11 per cent had a fixed telephone subscription. Today, mobile cellular penetration is approaching saturation with nearly seven billion subscriptions worldwide, representing a 96 per cent penetration level. Global fixed- and mobile-broadband penetration had reached 9.8 and 32 per cent, respectively, by the end of 2014[1]. While fixed broadband showed only cautious growth between 2013 and 2014, mobile-broadband subscriptions were three times higher than wire-line broadband connections worldwide and are growing fastest in the developing regions, where growth rates are twice as high as in developed regions. Mobile broadband has helped bring high-speed data and Internet services to unconnected areas[2].

But much more needs to be done to achieve universal access to Internet. In particular, the broadband divide between developed and developing countries remains large, with 82 per cent and 21 per cent penetration, respectively, for mobile broadband and 27.5 per cent and 6 per cent for fixed broadband[3]. ITU has estimated that there were 711 million fixed broadband subscriptions globally by the end of 2014[4]. One industry analysis firm forecasts that global fixed broadband subscriptions will reach 920.2 million by 2019[5], driven by consumer demand for high-speed Internet access and the proliferation of Internet-connected devices within the home and at the workplace.

Although 3 billion people worldwide were using the Internet by the end of 2014, and users are joining at a fast pace, with nearly a billion new users added over the last four years, accessing the Internet still remains a privilege. Indeed, 4.3 billion people were not online by end of 2014, of whom 90 per cent live in the developing world. Turning to mobile coverage, 450 million people still live out of reach of a mobile signal without access to the digital world[6]. Many millions more of ICT users lack the necessary digital literacy to have a meaningful Internet experience or access higher-paid, digitally literate jobs needing digital skills.

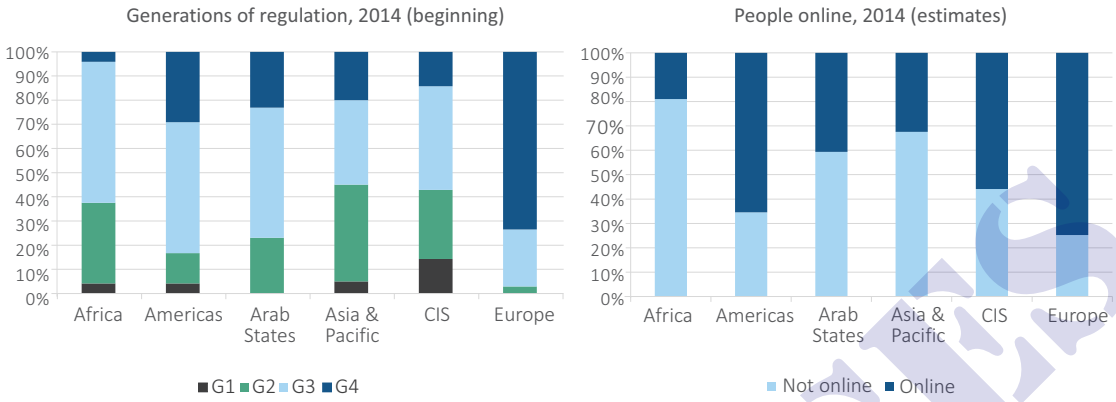
This is where ICT policies and regulations have a crucial role to play to create an enabling environment to bridge the digital divide. Regulation can enhance innovation and investment as well as infrastructure development, and can impact ICT services uptake and, in turn, affect economic growth and social development due the spillover effects of ICTs on other sectors of the economy. While there is no unique recipe for effective regulation, countries that have created an enabling policy and regulatory environment by following market developments and adapting and reforming their policy and regulatory frameworks to meet the requirements of the changing ICT environment are generally those that have shown higher levels of ICT adoption (see Figure 1.2).

Setting the conditions for ICT markets to flourish and remain vibrant, to attract investment and to foster innovation continues to be a high priority in most countries, alongside expanding universal access to the digital economy. This is why more than 140 countries have adopted national broadband-related policies, plans and digital agendas precisely recognizing the cross-sectoral and pervasive nature of ICTs on all aspects of the digital economy. More analysis of the impact of broadband policies and regulation on getting people connected is available in Sections 1.3 and 1.4.

Taking connectivity to the next level: smart devices and network growth

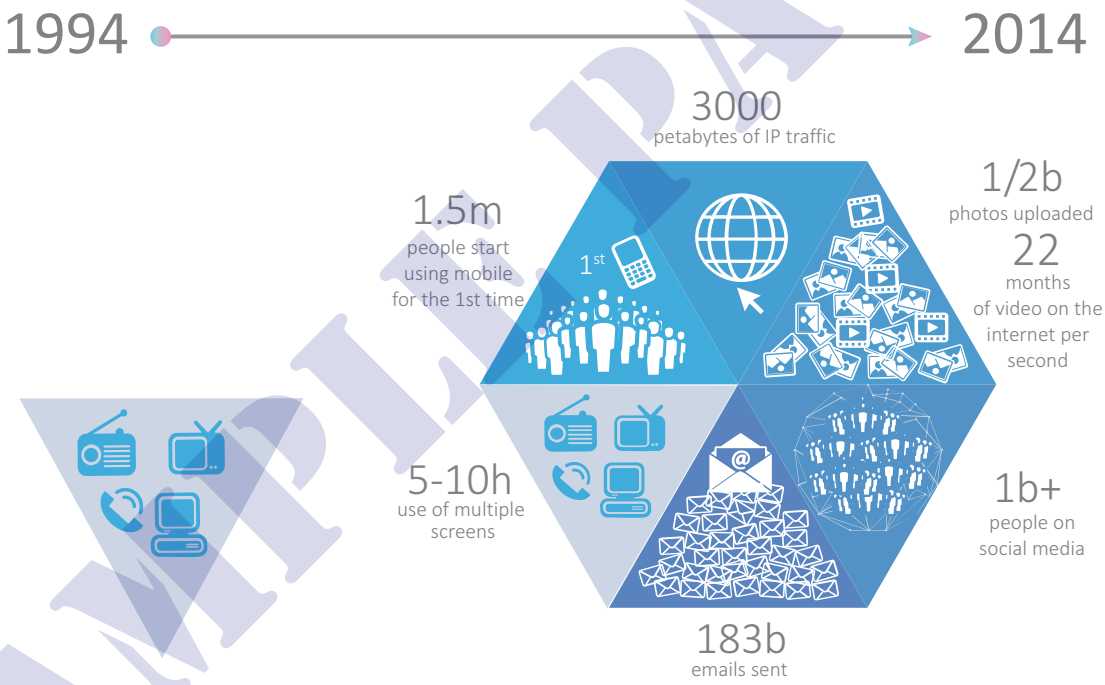
But it is not just the humans who are getting connected, things are also becoming smart. Sensors are deployed in a number of places to quantify (measure) almost anything from human, animals to machine activities. The Internet of Things (IoT), which connects many things to the Internet, and Machine to Machine (M2M) communications through cellular mobile networks are predicted to become the fastest-growing parts of the industry in terms of traffic. Many analysts agree that the Internet of Things (IoT) is now coming of age, and foresee strong growth in the IoT, which will also put additional pressure

Figure 1.2: Regulation matters: the link between connected ICT users and the maturity of regulation



Source: ITU.

Figure 1.3: A typical day in the digital world



Source: ITU.

on infrastructure development. Wearable devices are estimated to have reached 109 million in 2014[7]. One billion wireless IoT devices are expected to be shipped in 2015, up 60 per cent from 2014 figures, and resulting in an installed base of 2.8 billion connected devices by the end of 2015[8]. 25 billion networked devices are predicted to be connected by 2020, driven largely by consumer connected things (including businesses, hospitals, local authorities and other entities) and followed by manufacturing, utilities and transportation, transforming the concept of the Internet and the connected society irreversibly[9]. In terms of revenues, the market for IoT is expected to grow to USD 1.7 trillion by 2019 to become the largest device market worldwide[10].

Looking at devices, the demand for tablets is growing slowly and is expected to reach 234.5 million units in 2015[11]. Conversely, global shipments of PCs and laptops are expected to decline globally and to continue doing so over the coming four years[12]. Turning to smartphones, one consultancy predicts that

2 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)

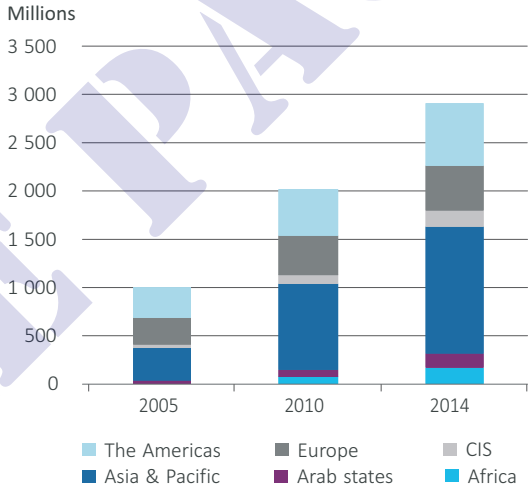
2.1 Introduction

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, 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 Internet users (see Figure 2.1) and 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] By 2017, estimates are that global Internet traffic will reach 35'000 GB per second, nearly a 350-fold increase from 2002, and a three-fold increase over 2012. Today, 40 per cent of the global population is using the Internet, and a fifth of Internet traffic is cross-border.[2] Notably, the most significant growth is in emerging markets such as Africa and Arab States – where between the years 2005 and 2014 growth was 934 per cent and 480 per cent, respectively.

Figure 2.1: Individuals Using the Internet



Source: ITU World Telecommunication/ICT Indicators database.

This chapter 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 2.2 addresses the impact of competition and the benefits that can ensue in a competitive ICT environment. Section 2.3 addresses the emerging competitive landscape; Section 2.4 identifies the key existing and emerging competition issues and how regulators are seeking to address them. Section 2.5 presents the overall conclusions of this chapter.

2.2 Why Competition Matters

Competition is a key element in realizing the benefits that advanced networks and services

3 New Frontiers in Spectrum Licensing

Authors: John Alden, Vice-President, and Catherine Schroeder, Associate, Freedom Technologies, Inc.

3.1 Introduction: Regulators under pressure

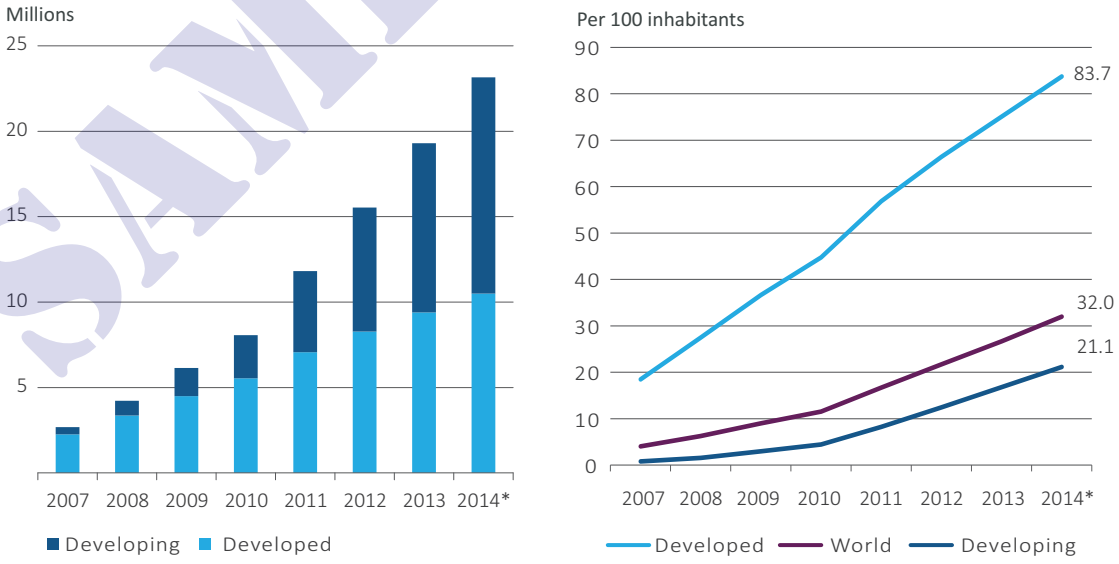
Spectrum managers in countries around the globe today face strong pressure to free up more spectrum for broadband wireless network access. Prompted by a sharp and accelerating rise in wireless broadband subscriptions in many countries (see Figure 1), regulators are scrambling to find more spectrum for 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 International Telecommunication Union (ITU), where the process of satisfying spectrum requirements for wireless broadband services begins, 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.

In the context of the ITU's framework for spectrum allocation – which is now building toward a WRC in November 2015 – regulators and telecommunication equipment manufacturers and network 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. Approaches based on spectrum occupancy database and sensing technologies are driving opportunistic sharing, challenging current licensing conventions.

This chapter looks at efforts now under way in some countries to accommodate broadband

Figure 3.1: Growth in mobile broadband, 2007-2014



Note: * Estimates

Source: ITU World Telecommunication /ICT Indicators database, www.itu.int/icteye

spectrum expansion while not compromising incumbent spectrum uses. It examines new approaches to spectrum sharing, such as licensed shared access (LSA) and 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 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. The analysis also considers the use of "small cell" and "local area" network topologies to augment traditional mobile cellular networks. And in the near future, efforts will increasingly 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 chapter prompt several 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 starting to be explored. But there is a broader question: are such fluid sharing and licensing strategies really needed – and if so, where and in what circumstances?

3.2 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 most people conceive of spectrum and how it is used.

Some spectrum engineers and policy-makers, however, have come to view the land-use 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 (scientists 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 the amount of usable frequencies and the number of users that can have access to specific frequencies.

Perhaps it is 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 licensing and 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 goal.

3.2.1 Current Spectrum Assignment Models

Before exploring the new experimentation in spectrum licensing, it might be useful to review how spectrum is currently assigned and how those methods have evolved. This is important, because in many ways, new ideas about spectrum licensing represent an evolution from existing frameworks.

4 Big Data - Opportunity or Threat?

Authors: Andrew J Haire, Chairman, AJH Communications & Dr. Viktor Mayer-Schönberger, Professor, Oxford Internet Institute

4.1 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 day to drive from home to work and back; providing real time information that allows them to avoid heavy traffic. 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 also 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. If one takes a photo of a horse galloping across the field every minute, then they are just a group of still 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: motion,; and the film industry was born. Something similar is now happening with Big Data.

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

This chapter is divided into four main parts: the chapter will begin by defining the concept, next, the contributions that Big Data offers to society and individuals will be explained; attention will then be drawn to some of the inherent risks of this powerful new technological tool; and finally, the chapter will conclude with regulatory and policy considerations that should be accounted for when crafting future policy.

4.2 Setting the stage

Over the past few years, the world of Big Data has rapidly evolved; both in the marketplace and in the research community. *What* we thought we knew just a few years back is now either changed or refined. Further, as in many other areas, the rules governing Big Data have been slow to adapt. The intent of this chapter is to offer a foundation; showing what Big Data is, explaining its recent history, and looking at where ICT regulators, policy makers and other authorities, such as competition authorities or data protection authorities (collectively known as Regulatory Authorities) have set or should set some boundaries. The chapter aims to provide a stronger appreciation both nationally and globally of what the term Big Data means and the various perspectives that are shaping current discussions.

More specifically, this is a chapter about Big Data, and its characteristics, its history, its future and most importantly what Regulatory Authorities can and should do to meet the challenges it poses without dampening the opportunities and benefits it can provide. It utilizes the diversity in the practicalities and uses of Big Data to increase awareness of the benefits and the risks; placing it in a context that allows for understanding of where the industry has been and where it could be going. For regulators, the question is: what can, or should, be done to carry out their responsibilities? Recognizing that no two

5 Consumer protection in the online world

Authors: Michèle Ledger, Javier Huerta Bravo, and James Thomson, Senior ICT Experts, Cullen International

5.1 Introduction

This chapter 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 engage in various types of activities online. It 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 also discusses the need for greater collaboration and cooperation at the regional and international levels. This chapter complements a previous study, *Regulation and Consumer Protection in a Converging Environment*, which was released by ITU in 2013.[1]

The discussion 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, making payments, consuming music and video, gaming and using apps, using social media and cloud services.

The analysis identifies a number of cross-cutting regulatory issues that need to be addressed by policy-makers, regulators[2] and industry to ensure that digital consumers are effectively protected, including:

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

It also highlights some of the approaches that have been taken around the world to protect consumers, and describes some recent attempts to address specifically the conduct of new market players, such as search engine, cloud and application service providers.

5.2 Setting the scene

5.2.1 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, etc.) and this trend is set to continue. A recent OECD report[3] highlights that e-commerce has been growing steadily since it first emerged in the mid-1990s with the establishment of companies like Amazon and eBay. From 2004 to 2010, e-sales grew from 9 to 14 per cent of the turnover of non-financial enterprises in the European Union, and from 10 to 16 per cent in the United States. The report also highlights, however, 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 per cent 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 (with a 30 per cent increase between 2009 and 2013).[4]

6 The economic influence of data and their impact on business models

Authors: Dr René C.G. Arnold & Dr Martin Waldburger, Senior ICT Experts, WIK Consult

6.1 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 derived from data collection and use. This indicates a trend towards data becoming a new driver of economic growth, with a significant impact on business models. This chapter 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 given rise to new business models that ultimately will result in a sustainable ongoing structural change in various markets, 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, maintenance and comfort functionalities. Home appliances have 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 process, otherwise, no meaningful services based on that data can be aggregated or successfully applied.

As policies and regulation have a significant impact on whether all the many 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 chapter develops a structural framework of the data-driven economy by defining stakeholder relationships – the data value circle- and analyses each segment of that structure. 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 future of each sub-market and the role it plays for ongoing structural change in the economy. 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" by giving up their data not their money, but seem to be largely unaware of this.

In light of these characteristics, the chapter analyses specific value propositions within the data-driven economy, as well as the business models that surround them. The focus is on 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 that characterize the data-driven economy and the strategic behaviour of its various stakeholders:

- Strong incentives to gather more and more data about consumers have to be balanced against 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 in order to cope with the global nature of the data-driven economy.

Section 6.2 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 6.3 develops the data value circle as a conceptual approach to understanding the structural framework of the data-driven economy. It allows a more in-depth understanding of the individual segments of the economy, as well as their interrelations, and also provides an initial analysis of the value of the data-driven economy; exploring the market size and development for each segment in the structure. Section 6.4 selects several key value propositions and their surrounding business models from the data-driven economy for in-depth analysis. In that section, the emphasis is put on the profitability and potential strategic options these business models enable, as well as the challenges that may emerge from these options for both participants in the data-driven economy, policy-makers and regulators. Finally, section 6.5 pulls together the insights gained, summarises the challenges that may emerge and sketches approaches for future policies and regulation in light of the anticipated strategic behaviour of stakeholders in the data-driven economy.

6.2 The evolution of the data-driven economy

This section traces 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 in the economy 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 the World Wide Web. 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 ensuring years – the number of websites increased from 10,000 in 1994 to 650,000 in 1997[1] – 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 analysis, 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 a user entered in the search field. Thus, it offered 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 so that they can 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

7 Monitoring the Implementation of Broadband Plans and Strategies

Author: Colin Oliver, Senior ICT Expert[1]

7.1 Introduction

A recent study shows that countries with a national broadband plan[2] have a better track record for expanding both fixed and mobile broadband penetration compared with countries that do not have a plan.[3] With all other variables held constant, countries with a plan have a 2.5 per cent higher fixed and 7.4 per cent higher mobile broadband penetration. The study also found that without a competitive market, broadband penetration is lower: 1.4 per cent lower for fixed and 26.5 per cent lower for mobile broadband access. A competitive market is thus a key engine of growth in many broadband plans.

As policy-makers seek to develop the most effective plans for driving broadband development, a key element is how to assess and analyse what approaches work and which do not. 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 elements that are common across countries 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 chapter 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 main theme of the chapter is that monitoring needs to be a fully integrated part of broadband plans and strategies. Monitoring can provide an information base for the initial development of plans and strategies, allow policy-makers to check the progress of particular policies and programs, and provide the information necessary to evaluate the effectiveness of particular strategies (or the need for changes) and reassess priorities and goals. Within practical limits, monitoring should provide information on all aspects of the broadband market/ecosystem, which can be difficult given that the scope of many national broadband plans is very wide.

This chapter reviews the issues around the monitoring of broadband plans as policy-makers' focus moves from:

- initial *deployment* to make broadband networks and access 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 this process occurs, performance monitoring helps to ensure that targets, costs, benefits and outcomes of projects and policies are measured and programs are well managed. This chapter therefore supplements the discussion of issues connected with monitoring the implementation of national broadband plans with examples of good practices.

7.1.1 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 pursued through a number of programs. Performance indicators will be required to measure progress against starting points, completion of key component elements and the ultimate achievement of targets and goals.

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