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Luxembourg a bastion of state ownership

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Luxembourg – A bastion of state-ownership in Europe?

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Abstract

Akin to many other European Union member states, over recent times the Luxembourgish telecommunications market is undergoing a process of market liberalisation, which is itself encapsulated by broader neoliberal tendencies. While many aspects of market liberalisation are similar to those in other European Union member states, there are others that appear to be highly distinctive. The government has simultaneously sought to liberalise the small telecommunications market while protecting the wholly state owned incumbent. Moreover, the state has created or participated in the creation of new companies, thereby deepening its presence within the telecommunications market, although the incumbent operator remains the predominant player. As a result, competition and market penetration – especially by way of international investment – has been curtailed and alternative fixed operators have found it difficult to gain access to public infrastructures while being unable to build out their own network infrastructure.

The current nature of the market raises four key questions that this paper will explore and seek to address. Firstly, how competitive (or ‘open’) is the marketplace? Secondly, how has the extensive presence of the state in the market shaped its development? Thirdly, will Luxembourg be able to maintain its current international ICT competitiveness in the short and medium term? Fourthly, why have international operators invested (or not) in a market as small as Luxembourg? To answer these questions, we construct an extensive and detailed timeline of political, technological, regulatory and competitive developments within the Luxembourgish market. Contrary to prevailing international trends displaying the hegemony of neoliberalism, we reveal how the Luxembourgish telecommunications sector has benefitted from the deepening of state involvement over time. This leads us to conclude that Luxembourg is indeed a bastion of state ownership, as the government has not followed other European countries to reduce both its ownership and intervention in the telecommunications market.

Keywords: Luxembourg, state-ownership, market evolution, competition

1. Introduction

Akin to many other European Union member states, over recent times the Luxembourgish telecommunications market is undergoing a process of liberalisation, which is itself encapsulated by broader neoliberal tendencies. Neoliberalism is a complex, dynamic and mutable constellation of economic policies, political objectives and ideologies that have become widespread since the days of Reagan and Thatcher. Actually existing forms of neoliberalism are much more nuanced than the mantra of 'freeing' private enterprise suggests which tends to be associated with the market deregulation, privatization and the contraction of state services. While many aspects of market liberalisation are similar to those in other European Union member states, there are others that appear to be highly distinctive. The government had simultaneously sought to liberalise the country's small telecommunications market while protecting a wholly state owned incumbent. The state has created or participated in the creation of new companies that provide high-speed fibre connectivity to international Internet peering hubs, and a commercially orientated local Internet exchange has been established. An alternative national high-speed network has also been developed, and several data centres built to stimulate competition.

The current nature of the market, that combines significant elements of state-ownership and entrenched operators with domestic and foreign investment and competition, raises several questions that will be addressed in this paper. Firstly, how competitive is the market? Secondly, how has the extensive presence of the state in the market shaped its development? Thirdly, will Luxembourg be able to maintain its current international ICT competitiveness in the short and medium term? Fourthly, why have international operators invested (or not) in a market as small as Luxembourg?

This paper tries to address these questions by investigating how the market has developed in Luxembourg. An overview of the current state of the market is provided that identifies the main operators as well as the relevant institutions. With this mind, the rest of this paper is divided into nine main sections. In the following section, relevant literature is recounted and the methodology adopted briefly outlined. Section 3 then provides an overview of Luxembourg. In Section 4 attention switches to describing the market contending with neoliberal processes before the role of government is outlined (Section 5). In Sections 6 and 7 the state of competition in fixed and mobile markets is respectively explored. The key issues that are identified are discussed in Section 8, and conclusions drawn in the final section.

2. Literature

With its green paper on telecommunications (European Commission, 1987), the European Union (EU) launched in 1987 the process of market liberalisation of telecommunications in Europe with the ultimate aim of creating a single European market. This involved market liberalisation of monopolies, the privatisation of state owned companies and the creation of the national regulatory authorities. As this has been extensively discussed, the literature that follows focuses on a range of issues that are relevant for our subsequent discussion of the process within Luxembourg.

Ungerer (2013) presents the history of the process and the different changes to the regulatory environment that happened over the last 25 years and examines the question whether the European telecommunications industry is ready for the Internet

age. Cawley (2013), more specifically, looks into how this regulation has helped to develop both mobile and broadband communications. Levin & Schmidt (2010) discuss the establishment of national regulatory authorities and how they differ in competence and ability in different countries. They also discuss what co-ordinating role EU could or should play. Melody (2013) provides a critical discussion of current regulatory framework and questions whether this is really appropriate to create a single market. Lemstra & Van Gorp (2013) argue that further reforms are indeed necessary to achieve this ultimate goal, identifying the major barriers that prevent its realisation as well as the additional economic value that a single EU wide market would generate.

Bauer (2009) shows that countries also try to develop their respective markets through individual policies and direct investments and how this helps create different telecommunications markets across Europe in terms of the numbers of competitors, the degree to which fixed and mobile markets are competitive, the presence of inter-platform competition and so forth. Bortolotti et al. (2002) discuss how countries have divested themselves completely or partially from their national telecommunications and whether this has resulted in productivity improvements.

In the absence of a single market and the inherent complexity of telecommunication markets within individual member states, it is perhaps not surprising that many examples of country case studies can be found within the literature. Some of these have focuses on development countries like Germany (Elixmann, Schwab, & Stappen, 2003), Switzerland (Elixmann, Höckels, et al., 2003), The Netherlands (Grajek, 2010; Rood & te Velde, 2003) or the United Kingdom (Deshpande, 2013; Howick & Whalley, 2007; Tookey, Whalley, & Howick, 2006). Studies have also examined rural areas within development markets (see, for example, Galloway & Mochrie, 2005) as well as developing countries such as Peru (Yamakawa, Cadillo, & Tornero, 2012) or Nepal (Whalley, 2006).

The countries examined in these and many other case studies are substantially larger than Luxembourg, in terms of both its population and geography. One exception is the examination of the Cypriot telecommunications market by Symeou (2009). Cyprus is similar in population and geographical size to Luxembourg. Symeou (2009) argues that the success of market liberalisation might be affected by the smallness of a country and, therefore, the evaluation of success of market liberalisation based on industry concentration might be inappropriate. Moreover, market liberalisation might not even be necessary, with similar overall economic welfare being achieved by regulators if they allow a small number of market participants.

To review and evaluate the situation in Luxembourg we draw on a range of secondary sources such as the annual reviews published by the National Regulatory Authority. In addition, data have been extracted from the implementation reports and digital agenda scorecards of the European Union (for example, European Commission, 2013a). The annual reports and websites of the different operators in the Luxembourg market were incorporated into the analysis, as was information from the Luxembourgish statistical office (Statec) and Eurostat. Finally, information has been collected from the archives of several Luxembourgish newspapers and journals.

Prior studies of Luxembourg's economy have been included in the analysis. For example, studies about the importance of the service industry in Luxembourg and its evolution since 1960 (for example, Gargano, 2012), the size and activities of the financial sector (for example, Michaux, 2013) as well as a study about the use of ICT

(for example, Airoidi, 2012) have been consulted. Finally, commercial sources of information detailing Luxembourg (for example, Datamonitor, 2010) as well as from several consultant reports (KPMG, 2012b; PWC, 2011) were included in the analysis.

3. Luxembourg

As shown in Figure 1 (below), Luxembourg is a land-locked country located between Belgium, Germany and France. It is also rather small, with a land area of only 2,586 km² and a population of 524,900 (Statec, 2012b). The official languages are Luxembourgish, French and German but many inhabitants also speak English. Luxembourg is a multicultural society, as reflected in the presence of people from across Europe living in the country. As of 2012, more than 43.8% of the total population is of foreign origin (Statec, 2012b). Consequently, Luxembourg is the European Union (EU) country with the highest number of foreign nationals as residents and the proportion of foreigners in the resident population is steadily growing. In addition, out of a total labour force of around 368,400, more than 143,400 are foreign cross-border workers that commute each day from primarily France, Belgium and Germany (Statec, 2012b)¹.

[Insert Figure 1 about here]

Luxembourg, or more formally the Grand Duchy, achieved full independence in 1867 and today is organised politically as a constitutional monarchy with a prime minister. The government has a strong reputation for efficiency due, in part, to a long tradition of cooperation between the largest two political parties motivated by the desire to achieve social cohesion and the creation of a business friendly environment². The Grand Duchy is a full member of all major international institutions and a founding member of the EU. A number of major European institutions, including the European Investment Bank, the Court of Justice of the European Union and the European Court of Auditors have their headquarters in Luxembourg.

An economy dependent on financial services

Luxembourg is one of the wealthiest countries in the world with a GDP per capita in 2011 of just over US\$ 90,000 (OECD, 2012)³. Luxembourg's industrialization began in the nineteenth century (Zahlen, 2008), driven by the steel industry⁴. Since the 1950's a diverse array of international companies have located in the country (Zahlen, 2008), attracted by Luxembourg's stable economic environment and small and flexible state⁵. In addition, due to its geographic location, Luxembourg has also seen, more recently, logistic service providers invest in the country⁶.

Overall, industrial activities generate around 13% of GDP and services the remainder (OECD, 2012). The services sector is dominated largely by finance, followed by real

¹ For more information see, for example Schmitz et al. (2012)

² The two main political parties in Luxembourg are the Socialist Party (www.lsap.lu) and the Christian Democrats (www.csv.lu).

³ However, this figure should be treated with caution because of the high number of cross-border commuters.

⁴ The steel industry continues to be important, albeit in a different way, as Arcelor Mittal, the world's largest integrated steel and mining company, is headquartered in Luxembourg.

⁵ For example, Delphi, DuPont de Nemours, Elcoteq SE, Electrolux, Ferrero, Goodyear, Guardian Industries, IEE, RTL Group and SES have all located in Luxembourg.

⁶ Examples of such companies include Cargolux, DHL, Kühne & Nagel and Panalpina.

estate, leasing and consulting services (Gargano, 2012)⁷. Initially triggered by external factors, the banking industry took advantage of its highly experienced and skilled work force, its substantial international clientele and the favourable regulatory environment to dramatically expand the range of services and products that it offered (Zahlen, 2008). As of 2012, 143 banking institutions offering the entire spectrum of corporate and private banking services, could be found within Luxembourg (Statec, 2012a). It is worth noting that investment funds play a significant role within the financial sector, managing in July 2012 funds totalling almost € 2.3 trillion (KPMG, 2012b). Successive EU directives that liberalized the marketing of investment funds contributed to the growth of the financial sector in Luxembourg, as did the attractive fiscal framework implemented by the government.

The country's large number of private banking clients also benefits the insurance sector. Insurance companies sell various products that are used by institutional clients as asset management tools. Approximately 244 reinsurance companies are licensed to operate in Luxembourg, with these companies managing about € 50 billion of investments (KPMG, 2012a). Around 15% of the reinsurance companies are part of an insurance group, with the remaining 85% being part of industrial, financial or trading groups (KPMG, 2012b). Luxembourg is also emerging as a leading EU location for the cross border life insurance industry. One factor that has facilitated the development of this business is the regulator's constructive approach to new products, such as multi-currency life insurance contracts and unit linked life insurance contracts and, again, an attractive fiscal environment (KPMG, 2012b).

Being acutely aware of the country's dependency on the financial sector (Bourgain, Pieretti, & Høj, 2009), the government is increasing its efforts to diversify the economy (Schneider, 2012). The government has started several initiatives to attract companies that are active in the health and biotechnological industry. Over the last decade it has successfully attracted investments in logistics and e-commerce, and, more generally, it also tried to stimulate competition in telecommunications and ICT (PWC, 2011). In addition, new legislation was enacted in 2009 that provides for additional incentives relating to research and development (R&D)⁸. The country, however, spends just 1.6% of its GDP on R&D related activities⁹.

Information and communication technologies

Information and communication technologies (ICTs) are arguably well developed in Luxembourg. As shown in Table 1 (below), in 2013 almost everyone in the country owned a personal computer and had access to the Internet. The proportion of households accessing the Internet via dial-up is declining, while both broadband and DSL seem to have peaked. Interestingly, according to Airoidi (2012), just over 60% of the population use mobile Internet access.

[Insert Table 1 about here]

In 2012, among the enterprises with 10 or more employees, practically all (98%) have access to the Internet. Almost all of these connections occur through broadband access (95%), and many enterprises (54%) also have a mobile connection (Statec,

⁷ The services sector accounts for 28% of GDP, compared to 22.5% for real estate, leasing and consulting services (Gargano, 2012).

⁸ For more information see www.fnr.lu

⁹ For more information see www.luxinnovation.lu

2012a). Three quarters of the enterprises have their own website, and almost half an Intranet (Statec, 2012a).

Information technologies and e-commerce are growth areas for Luxembourg. Luxembourg was the first European country to create a specific, clearly defined and secure legal framework for e-commerce (PWC, 2011) and it also has the lowest standard rate of VAT at 15% on such services within the EU. The VAT rate levied on e-books is just 3%¹⁰. These attractive rates of taxation, together with good communication infrastructure, has led several players in the gaming and gambling sector to set up their headquarters in Luxembourg or even build their European technology centres in Luxembourg¹¹. This has, in turn, encouraged low-latency Internet providers to expand their ICTs operations to include Luxembourg (PWC, 2011). Although global media and Internet brands like Amazon and PayPal, as well as large telecommunications companies like Vodafone have all invested in Luxembourg, the fiscal advantages noted above are due to disappear in 2015 as new EU regulations come into force (Fayot & Funck, 2012).

This has, however, not stopped the government promoting Luxembourg to the ICT industry. The government has sought to encourage the creation of new businesses - through, for example, initiatives like 'Luxembourg for Business' or 'Proud to Promote ICT'¹² - and has stated its eagerness to further develop the ICTs sector in line with the major industry trends (Service des Médias et des Communications, 2013). Efforts are also being made to develop ICTs research with a focus on the security, reliability and trustworthiness of ICTs systems and services.

ICTs market size

Unfortunately there are no officially published figures regarding the size of the ICTs market in Luxembourg. Table 2 (below) draws on a variety of sources to provide an overview of the ICT¹³, highlighting in the process the main trends that have occurred. The table clearly demonstrates the important role that the ICT sector plays in Luxembourg's economy, and, despite the financial crisis that began in 2008, it has continued to grow over the last 5 years. The sector has also regularly created several hundreds of additional new jobs each year.

[Insert Table 2 about here]

It should, however, be noted that Table 2 does not include the turnover generated by international e-commerce operators located in Luxembourg. This turnover is largely generated outside of Luxembourg and mainly linked to a specific EU VAT regulation. Again these figures are not completely known, but some estimates indicate that for VAT revenues alone about €2,000 million is generated by the different players.

4. Liberalisation and the ICT market

Starting in 2003 the regulator¹⁴ has published an annual statistical report of the telecommunications market in Luxembourg. Using these reports and other documents

¹⁰ See <http://www.guichet.public.lu/entreprises/en/fiscalite/tva/notions/e-commerce/index.html>

¹¹ Examples here include OnLive Inc. (which implemented a cloud gaming platform and chose Luxembourg to locate all its servers for the European distribution of its services), Big Fish Games, Agapier, Bigpoint, Kabam-Europe, Nexon Europe Sàrl and Innova.

¹² See <http://ict.investinluxembourg.lu/>

¹³ As the sources used do not always present the data in the same way, the table has been discussed with some government officials and representatives from other stakeholders.

¹⁴ See www.ilr.public.lu accessed 31.5.2014

such as the Digital Agenda scoreboards published by the European Commission, Table 3 has been compiled to provide an overview of the major events that have occurred since the start of 1990s.

[Insert Table 3 about here]

Revenues and fixed vs. mobile

As Figure 2 shows, the size of the market has grown considerably since 1999. This is largely due to several consecutive technological changes such as GSM and UMTS as well as the widespread adoption of the Internet and broadband Internet access just after the turn of the millennium. From 2007 onwards the overall size of the market has stagnated, though with a slight drop in 2009 and 2010 due to the economic crisis encountered by the Eurozone.

[Insert Figure 2 about here]

Three mobile operators are active in the country: LuxGSM, Tango and Orange. LuxGSM is the mobile arm of the incumbent operator, while Tango and Orange are wholly owned subsidiaries of Belgacom and Orange/France Télécom respectively. Due to the small (geographical) size of the country and a large number of daily cross-border commuters, there is also substantial competition from German, French and Belgium network operators who rely on what is termed 'cross-border technical unavoidable spill-over' to serve customers. However, this spill-over does not reach into the main business areas in either the south or centre of Luxembourg.

Mobile revenues grew quickly between 2000 to 2003 until the market was saturated when penetration reached 140% of the population (ILR, 2014). Due the small size of the country and the high number of foreign workers, roaming charges constitute a substantial part of mobile revenues (ILR, 2014). These revenues, however, have stagnated or even begun to decline because of the price reductions imposed by the EU (Luxemburger Wort, 2013). Since 2010 mobile market revenues have exceeded those of the fixed telecommunications market, primarily due to the growth in mobile (broadband) Internet access (ILR, 2014). Fixed telecommunication revenues have remained flat over the period under study. However, a closer examination reveals that revenues from fixed voice telephony services have decreased while those from leased lines and broadband Internet access have grown. As a consequence, the latter is offsetting the decline of the former.

[Insert Figure 3 about here]

Entreprise des Postes et Télécommunications – the incumbent

Established in 1842 as a public administrator of post and telecommunications, EPT was converted into a 100% state owned enterprise in 1992. Table 4 (below) identifies the major milestones in the development of EPT. However, over 150 years of existence as a public administration have arguably left a deep impact in terms of structure and culture of the organisation. The company is controlled by the Ministry of Economy, with a board composed primarily of government and union representatives.

[Insert Table 4 about here]

The company is organised into 3 divisions: postal, financial and telecommunication services. Although the proportion of total revenues generated by telecommunication services is declining, almost 60% of EPT's total revenues are generated by ICT

related activities. This decline reflects the increasing competitive nature of Luxembourg's ICT market, a development that has encouraged the company to search for new opportunities. One aspect of this has been the desire of EPT to diversify its own operations, while another has been its willingness to acquire companies to broaden the portfolio of services that it offers. Altogether the EPT group employs about 3800 people which makes it the fifth largest employer in Luxembourg (Statec, 2012b). Table 5 below shows the group as of beginning 2013.

[Insert Table 5 about here]

Some of these subsidiaries have been successful and contribute substantial sums to EPT's ICT related revenues: ebrc, for example, has revenues of approximately €30 million and Netcore around €25 million (Gaudron & Ducat, 2013). The contribution of these companies helps explain the substantial increase in telecommunication revenues that has occurred in recent years.

In an interview in 2010, the then CEO identified the main strategic priorities of the group as the following: the functional separation between telecommunication services and networks¹⁵, the full market liberalisation of the postal sector in 2013 and the roll-out of a country wide Fibre-to-the-Home (FttH) network (Gaudron, 2010a). More recently, the new CEO, in the context of the presentation of a new brand, added the importance of a new and unified company culture for EPT and its subsidiaries (Gaudron, 2013). He also emphasised the social role of an entity that is 100% state-owned and the importance of the three different activities (Zeitung, 2013). Perhaps surprisingly, the CEO also announced that EPT would look for new opportunities outside of Luxembourg (Müller, 2013).

5. Institutions and policy initiatives

The government is a key player within Luxembourg's ICT market. In this section, the different institutions that play a role in shaping policies and regulating the market will be outlined. This will then be followed by an overview of some of the major initiatives that have been taken.

Institut Luxembourgeois de Régulation

Initially set-up in 1997 as 'Institut Luxembourgeois des Télécommunications' (ILR, 2008) with 2 employees drawn from EPT and an externally recruited director, it developed by 2008 into a 50 person administrative body regulating utility sectors - telecommunications, electricity, gas, railways and post - as well as coordinating the use of radio frequency resources and protecting customers. ILR is not involved in developing telecommunications policies; instead, its mission is to implement these as well as to implement the different EU directives related to the so-called 'telecom packages'

Its first major task was a licence application process in 1998 for the second mobile operator¹⁶, which was organised with the help of Arthur D. Little as a 'beauty contest' based on coverage, service offering and quality (ILR, 2008). This approach was repeated for all subsequent major licence application processes as it was felt that it would not be appropriate to jeopardize the business cases of the applicants by requiring (large) up-front payments.

¹⁵ A initial project proposed by EPT has not yet been accepted by ILR (Gaudron, 2012)

¹⁶ This was won by Millicom SA and operated under the brand name Tango. Its licence fee was linked to annual turnover.

ILR then focussed on the market liberalisation of the fixed networks. Initially it defined different categories of licences¹⁷, and subsequently through requesting EPT to publish reference interconnection and later reference unbundling offers at increasingly competitive prices (ILR, 2012a). Following EU regulations (Sutherland, 2008), number portability for fixed (ILR, 2000) and mobile numbers (ILR, 2005) were introduced in 2000 and 2005 respectively.

In 2002 ILR launched a first call for applications for four 3G UMTS network licences (ILR, 2009a), which were allocated initially to the two existing 2G mobile operators plus Orange. There was no candidate for the fourth licence. In 2003 this fourth licence was advertised again, divided into two and awarded to Luxembourg Online and Astralis. In 2004, Orange returned its licence and this was awarded to Luxcommunications SA who started 3G operations under the name of VoxMobile soon after. In 2006, ILR launched an additional call for applications for 2G Edge and 3G spectrum, which was also awarded to Voxmobile (ILR, 2007). In 2007 ILR launched two calls for applications for a broadband wireless access network (ILR, 2009a), with a licence being awarded to Luxembourg Online and its partner. They never launched their services with the result that the licence was taken back by ILR in 2009 (ILR, 2009b).

A considerable amount of effort has been spent on coordinating radio frequencies (Dard, 2013, Paperjam, 2013b). This activity is particularly difficult due to the small size of the country and the need for international satellite communication frequencies to be used by SES and, to a lesser extent, RTL Group.

As ILR has never been a very aggressive regulator (Waverman & Koutroumpis, 2011, Zenhäusern et al., 2012) it is no surprise that it has rarely imposed its decisions. Instead it has opted to negotiate compromise solutions that are acceptable to all of the stakeholders involved. It has also sought to avoid making mistakes as well. Unlike some EU member states, ILR has not auctioned spectrum but instead preferred to allocate spectrum through a series of beauty contests. By adopting such an approach, ILR avoided the start-up problems and high consumer prices that occurred in those countries that auctioned, for example, their 3G licences.

Service des Médias et des Communications

The Service des Médias et des Communications¹⁸ (SMC) is associated with the Minister of Communications, but in contrast to ILR it is the body responsible for defining and promoting the policies decided by the government in the areas of electronic communications, e-commerce, electronic security and media. As a result, its main activities consist in promoting Luxembourg internationally, advising the Minister of Communications¹⁹, supervising the local media sector and representing the government in different national companies and international organisations.

In 2001 an action plan - eLuxembourg - was implemented to promote the use of the Internet and to move the public sector towards solely communicating with the public electronically. The result was the so-called eSpace as a means of interacting with most, but not all, of the public sector. However, no specific budget was allocated to the initiative and no single government department was in charge. It is no surprise,

¹⁷ Licenses have subsequently been replaced by declarations.

¹⁸ See <http://www.mediacom.public.lu/> for more information.

¹⁹ Currently, the Prime Minister is also in charge of Communications

therefore, that this initiative gradually faded away without much success being achieved.

In 2004, prompted by the EU's i2020 initiative, SMC presented a national action plan for broadband internet access (SMC, 2009). The objective was straightforward: to reach 95% of population. This goal was quickly achieved, with Luxembourg becoming one of the first OECD countries to achieve 100% DSL-based broadband coverage.

In 2005 the Government, together with several local banks and EPT, set up Luxtrust, a local electronic signature system. Luxtrust plays the role of the certification authority and delivers certificates on USB sticks or SIM cards²⁰. This technology is extensively used in Luxembourg for e-commerce and e-banking as well as for communications between the state and public.

In 2006 SMC was the driving force, together with the then Minister of Communications, behind the creation of LuxConnect (LuxConnect, 2013). Also during 2006 SMC was actively involved in Luxembourg becoming the first EU member state to transpose the directive regarding e-commerce and electronic signatures into the local context. Two years later, a specific legal framework was created to facilitate the management of intellectual property and internet domain names (SMC, 2010b). In 2009, SMC was involved in the creation of Lu-CIX (Henry, 2014a), a commercial Internet peering point to which all of the local operators quickly connected.

LuxConnect

Over the course of 2004 and 2005, ILR assessed the fixed network market, focussing on the international and national high-bandwidth connectivity for commercial users. National operators were complaining that they were experiencing difficulties obtaining access rights and accessing existing trenches to install their own fibre optical cables. International operators were often stopped at the national boarder and forced to use expensive leased lines in order to reach the main business areas in Luxembourg City. During international economic missions, the government promoted Luxembourg's tax advantages in order to attract foreign investors. In particular, e-commerce providers, who were required by the European Commission to have a base somewhere in the EU, were targeted (SMC, 2010b). However, most of these initiatives failed because of technical reasons linked to missing international connectivity.

After some discussions between the Ministry of Economy and EPT, it was decided to set up a second 100% state owned operator. This new company would:

- Build a national dark fibre network. This would be made available to telecommunications operators so that they can build and enhance their own footprint in Luxembourg.
- Operate a network that connects Luxembourg to the Internet exchanges in Amsterdam, Brussels, Frankfurt and Paris. Distances would be minimised while route and fibre diversity maximised.
- Support the national ICT, media and e-business sectors by providing carrier neutral, state-of-the-art data centre facilities (LuxConnect, 2013).

²⁰ See www.luxtrust.lu for more information.

The project was allocated an initial budget of €30 million. By the end of 2012, LuxConnect employed 23 staff, had capital of €75 million and had invested over €92 million developing its business.

Interestingly LuxConnect does not define itself as a telecommunications operator and is probably best described as a 'carrier's carrier'. As the company provides its services only on a business-to-business wholesale basis. Its customer base is made up exclusively of telecommunications operators, system integrators, hosting and software-as-a-service companies. The services are offered on a strictly neutral and non-discriminatory way: identical pricing and support are provided to customers accessing the same product or service under matching conditions. It provides raw datacentre capacity as well as dark fibre or high bandwidth connectivity using a cost-plus pricing scheme (LuxConnect, 2013).

Operations commenced in 2009 with a first data centre and an international fibre optical network. Since then, the company has arguably been very successful (Journal, 2013). LuxConnect has contributed to the development of a second and commercial national Internet peering point (Lu-CIX) and facilitated the establishment of a wholesale cloud service, namely Luxcloud (Bova, Plummer, Petri, Malinverno, & Govekar, 2014).

Ultra-High Broadband Strategy

In 2010, ILR, together with the Ministry of Economy and the Minister of Communications, published a report outlining Luxembourg's future broadband strategy (SMC, 2010a). They claimed that both productivity and GDP growth requires ultra-high bandwidth connectivity for all households. Broadband connectivity was viewed by the government as being part of the incumbent's universal service obligations that stated that by 2020 every household should have access to a connection with speeds of 1 Gbit/s upstream and 500 Mbit/s downstream (SMC, 2010a). The following rollout targets were set:

- 25% of population by 2013
- 50% of population by 2015
- 100% of population by 2020

In addition, an intermediate objective of every household having at least 100 Mbit/s download and 50 Mbit/s upload by 2015 was set. Ultra-high bandwidth business zones would also be established²¹, connected by two independent networks in order to guarantee full redundancy. The government also announced two other, somewhat vague, objectives: to become a 'world leader' in terms of broadband connectivity penetration and to achieve competitive pricing in line with the EU average (European Commission, 2013b).

The Government, as their sole shareholder, asked EPT to invest about €180 million until 2015 to fund the initial rollout. It was agreed that EPT would install at least 4 fibres into each home and grant access to alternative carriers to one or more of these on a non-discriminatory basis (SMC, 2010a). Cable TV operators were encouraged to develop their own networks as an alternative, with its independency of the incumbent's infrastructure ensuring that redundant access to 95% of households in Luxembourg was possible (SMC, 2010a).

²¹ It was not specified how many of these zones exist, and where they are located.

Several additional measures were agreed. A centralised database detailing network infrastructure across the country would be established²², as would a second database focusing on civil works projects. In-house cabling would be made mandatory for all new buildings. LuxConnect also was asked to push the development of their national networks and in particular to connect to the main business zones while ILR was invited²³ by the government to proceed as quickly as possible with the frequency planning and licensing process for 4G LTE services. For its part, the government promised to transpose the 2009 EU telecom package immediately into national law.

In April 2012, SMC and the Ministry of Economy commissioned a study to review the broadband strategy announced in 2010 (BooZ&Co, 2012). This new study proposed a closer collaboration between EPT and cable-TV operators with the aim to use the latter's existing networks to offer broadband connectivity in the less densely populated areas in the north of the country.

In May 2013 the Ministry of Economy and Foreign Trade announced that additional funds would be made available to speed up the rollout of the broadband infrastructure (Ministère de l'Économie, 2013). Through doing so, it was hoped that the country's economic recovery would hastened. Overall EPT and LuxConnect are now expected to invest over €1000 million over the period from 2013 to 2017 (Ministère de l'Économie, 2013).

6. Competition in fixed networks

ILR, in their official list of operators within Luxembourg, identified 88 different operators, 37 networks and 240 service providers at the end of 2012 (ILR, 2012b). EPT is, by far, the largest of these although Figure 8 (below) shows that the market share of EPT is declining, the company still generates almost 80% of the sector's fixed revenues. Notably, revenues from other operators began to grow in 2007, the year in which LuxConnect launched its operations. Through the use of its infrastructure, other operators were able to provide services to enterprise customers and thus increase their market share and revenues over time.

[Insert Figure 8 about here]

In common with many other countries, revenue from the fixed line sector has been falling steadily in recent years. Since 2005 the revenue generated by mobile telecommunications has by far exceeded that from fixed. Having said this, the decline in voice telephony communications revenues has been partially offset by the growth of broadband revenues. However, as can be seen from Figure 9 (below), broadband revenues have begun to fall after several years where they were stable.

[Insert Figure 9 about here]

Telindus Telecom

Telindus was initially established as an ICT integrator by a private investor in cooperation with Arcelor-Mittal²⁴ in the 1980s. Over time it became the country's largest ICT integrator, with more than 350 employees and a turnover of about €70 million (Paperjam, 2013a).

²² Which at the moment (May 2014) does still not exist.

²³ This is the actual term used in the presentation of the plan.

²⁴ The world's largest steel producer, which was then ARBED

At the end of 2005, after the death of the private investor, Belgacom acquired Telindus Belgium and Luxembourg (Lightreading, 2005). Through this acquisition, Belgacom extended their product range to be able to offer enterprise customers not only traditional connectivity and leased lines, but also LAN, voice and IT services as well.

In 2011, using the infrastructures offered by LuxConnect, the Luxembourgish branch of the company changed its name into Telindus Telecom and became Belgacom's ICT full range ICT service provider for Luxembourg. The company focuses solely on commercial customers, offering services such as connectivity and software. It is the main competitor to EPT in the lucrative enterprise market.

This successful business model has been copied by several smaller operators or ICT integrators like Telecom Luxembourg, BCE, Datacentre Luxembourg and Orange Business Services. They individually play a minor role in the market when compared to either EPT or Telindus Telecom. Nevertheless, most of these operators would not exist without the creation of LuxConnect and in that respect the government's intention to stimulate competition appears to have been successful.

Artelis

Artelis was initially set up in 1999 under the brand name of Cegecom (Cegecom, 2013) by Cegedel²⁵, the local electricity company. The intention was to use the fibre optical cables inside the high-tension electricity lines to offer services to enterprise customers. However, it quickly became clear that these lines were not close enough to the end customers and certainly would not cover the main business centres. Thus, Artelis tried to develop their own local access network and tested several technologies over time - Powerline, Wireless Local Loop (WLL) and Microwaves - before acquiring the country's only WLL operator Firstmark²⁶. They also relied on EPT's reference unbundling offer as well as continuing to develop their own national fibre back-bone infrastructure (Gaudron, 2010b).

Around the time of its launch, Artelis considered itself as the main national competitor to EPT and even tried to enter the residential market with Internet access and fixed voice services under the brand name 'Bamboo' (Cegecom, 2002). They also stated their intention of applying for mobile licences, but gave up twice at the last minute²⁷.

In 2006, the company merged with VSEnet²⁸, a similar organisation based in the German state of Sarre that they had already cooperated with for some time. At this point company was rebranded as Artelis (Artelis, 2013). The merger changed the shareholder structure so that it became VSE AG (53.05%), Enovos International S.A. (36.95%), and Saar LB (10%).

Since the merger Artelis has sought to provide high-speed data connectivity and act as a carrier's carrier for the main business centres and small and medium sized enterprises. Significantly, its geographical focus is now on greater Luxembourg region and the surrounding areas of Germany. It is on this basis that Artelis claims to be the only international operator based in Luxembourg.

²⁵ This company is now called Enovos.

²⁶ See http://archiv.ringpfeil.net/firstmark/_purehtml/markets/en_luxembourg.htm for further details.

²⁷ Author's interview with former CTO of Artelis

²⁸ See www.vsenet.de for further details.

Luxembourg Online

Founded by two private investors in 1995 as an Internet service provider, this company gradually emerged as the only independent local operator that is fully owned by private local investors. In 1997 Luxembourg Online (Luxembourg Online, 2014) launched one of the first e-commerce platforms in Luxembourg and in 1999 it began offering free Internet dial-up access that is based on call-termination revenues from in-bound calls (Luxembourg Online, 2013). In 2001 the company applied for a full voice licence and became the first operator to offer both free Internet and free voice based on a flat-fee local loop bought in from EPT and Cegecom (Luxembourg Online, 2014).

In 2003 Luxembourg Online launched its broadband Internet access, again based on local access from EPT as well as an Internet access product via cable TV networks as it had no infrastructure of its own. In 2004 it started to offer alternative voice products to the residential market, though these met with limited success (Luxembourg Online, 2014). As a consequence, it moved to VOIP and became the country's first operator to offer such a service to its broadband Internet access customers.

In 2006 Luxembourg Online applied for the fourth UMTS licence, but failed with the licence being awarded to Astralis. It appealed and was awarded a half-licence in 2008 (ILR, 2009b). ILR, in order to avoid deciding in favour of one party over the other, simply split the available wireless spectrum into two equal halves. However, to date, Luxembourg Online has never used its licence. Instead Luxembourg Online established a mobile virtual operator based on the resale of services provided by Orange, branding the service as LOL mobile. In 2007, it also applied, together with Broadcasting Center Europe, for a 3,5 GHz WiMax licence (ILR, 2009a). Once again, although it was successful in its application, the licence has not been utilised.

In 2011 Luxembourg Online launched its own IPTV service. It was partnered in the venture by several cable TV operators, Tango and EPT. In the following year, it created a joint venture with Eltrona, the country's largest CATV operator, to offer triple play services over cable TV networks²⁹.

7. Mobile competition

As highlighted above in Figure 2, the size of the mobile market when measured by revenues has exceeded that of the fixed telecommunications market since 2005. Although revenues were stable between 2005 and 2011, they have begun to grow once more. According to ILR, LuxGSM controls just over 53% of the market, with the remainder being split between the two other operators (ILR, 2014). This split has been very stable over time; there was a slight decrease when the third mobile operator launched its service in 2005, but the subsequent introduction of mobile number portability has not led to any noticeable change.

[Insert Figure 10 about here]

Due to unique characteristics of the Luxembourgish labour market and the small size of the country, roaming revenues are very important. The recent decision of the EU to impose price caps on voice and data roaming (Cuvelliez & Dricot, 2013; Luxemburger Wort, 2013) will, therefore, lead to considerable reductions in the roaming revenues of operators. Given the revenue split highlighted in Figure 11 for

²⁹ Further details can be found at http://www.eltrona.lu/offres_trio.htm.

2012, this decline is likely to have a far-reaching impact on Luxembourg's mobile operators.

[Insert Figure 11 about here]

This together, with a substantial reduction in average revenue per user around 2009 that is evident in Figure 12 (below) due to the economic crisis (ILR, 2011) resulted in a fairly flat evolution of mobile revenues between 2005 and 2010. The decline in national voice revenues that is evident in Figure 11 has partially been offset by the increase in smartphones and the associated revenues.

Tango

Tango has been active in the Luxembourgish telecommunications market, initially in the fixed (voice) market and, more recently, in the mobile since 1989. During its first decade, when it was known as 3C Communications Luxembourg, the company attracted the interest of a number of investors such as Bank Invik, Millicom International Cellular, Mach, Transcom, Transac and Tele2 Europe (Tango, 2013a).

A group of investors with Millicom and Bank Invik at its core won the beauty contest, which was based mainly on speed of rollout and coverage, in 1997 (Tango, 2013a). The company started operations in 1998 under the brand name of Tango. Success was more or less immediate: the company's services and products attracted substantial numbers of subscribers during the launch phase. The company now claims a market share of over 40% and around 270,000 subscribers (Tango, 2013b). GSM network coverage was extended and a fixed-line network set up in parallel using EPT's access network and Tango's voice switching system. This service was commercialised in 2005 under the brand name of Tele2 Luxembourg (Tango, 2013a).

In the early 2000s Tango achieved a series of firsts: it was the first company to launch WAP services, a data (GPRS) network and UMTS-based services. In 2005 the company launched the first bundled offers³⁰, followed in 2007 by the first HSPA-Mobile ADSL network supporting speeds of up to 7.2 Mbit/s (Tango, 2013a).

In December 2008 Belgacom Group bought Tango from Tele2 Europe for a reported €210 million (Tango, 2013a). This was the first major commitment by a larger international operator in Luxembourg³¹. Since the sale to Belgacom, Tango has continued to invest into its network infrastructure and was the first operator in October 2012 to launch a commercial LTE data service (Tango, 2012a). They also launched, around the same time, an IP-TV service using EPT's and Artelis' unbundled DSL packages (Tango, 2012b).

The company claims to have over 40% market share with about 270,000 mobile subscribers (Tango, 2013a). Being part of the Belgacom group, it co-operates actively with Telindus Telecom³² to offer specific fixed/mobile bundles to corporate customers.

Orange

In 2003 the two CEOs of Tango, together with several local investors, decided to set-up a third mobile UMTS only operator called VoxMobile (Orange, 2013). The licence was quickly awarded. Interestingly they also convinced EPT to act as an MVNO host

³⁰ These combined fixed services with DSL-based Internet access and mobile provision.

³¹ The Millicom Group has a history of acquiring and developing mobile operations, often in Africa, before divesting them.

³² See the Telindus website, www.telindus.lu, for more information.

so that they could swiftly start providing 2G operations. Again, the success was more or less immediate, mainly because of a strong marketing campaign and the offer of a free life-long subscription. However, the company experienced problems with the availability of 3G devices with the consequence that of their customers used 2G instead. As such, significant revenues accrued to EPT as their MVNO host.

As a consequence, in 2005 the company took the decision to launch its own 2G network. This had a significant negative impact on their operations that resulted in additional financing being sought ó a reputed extra p10 million was sought from the company's shareholders³³. In 2007 additional financing was provided by Orange/France Télécom through Mobistar, its Belgium mobile operations, and resulted in the company increasing its stake in VoxMobile to 90%. In the following year Orange/France Télécom acquired the remaining 10% and, beginning from the start of 2009, changed the company's brand to Orange (Orange, 2013).

A 4G network was launched in the autumn of 2012. Notwithstanding the expansion of the company and the use of a well-known brand name, the company is the smallest of the three mobile operators with a claimed subscriber base of about 100,000 subscribers (Raizer, 2013).

8. Discussion

The previous sections have described various aspects of the liberalisation of ICT markets in Luxembourg. The country has not been at the forefront of neoliberal trends in Europe, but instead has adopted an approach that could be best described as being an 'informed follower'. This may be partially due to the small size of Luxembourg and its telecommunications market that leads to limited competitive pressures and the relatively low interest among larger operators to establish operations³⁴. It could, however, also be a consequence of a political desire to protect the incumbent, who, with over 3800 employees, is one of the largest employers in the country, representing an important reservoir of 'voters' and contributes a considerable amount of tax revenue. In addition, the regulatory body without the benefit of any form of institutional antecedents, and it also had to grapple with limited resources and little experience, at least initially.

EPT still dominates most market segments and, in that sense, market liberalisation does not appear to have pervaded the operating environment as is the case in many other countries. EPT still controls around half of the mobile market, and almost all of the fixed, Internet and broadband Internet access markets. Having said this, the ICT revenues of EPT are stable while those of competitors are steadily growing but are still far lower than those of the incumbents.

EPT has not necessarily been at the forefront of innovation, new technologies or service developments. They tended to follow the developments of neighbouring countries and their incumbent operators and 'mimic' that is, copy, their behaviour. It is, therefore, no surprise to note that a range of services ó mobile data, broadband, LTE, cloud services ó were introduced between 12 and 18 months after their introduction in surrounding countries. It is also fair to state that the small size of the local market and their limited experience also prevented them from swiftly introducing new services.

³³ Author's interview with former CEO of VOX

³⁴ For a broader discussion of smallness see, among others, (Symeou, 2009).

Prior to 2000 some national organisations like utilities and media companies diversified into the telecommunication market while remaining nationally focused. Two factors, however, negatively affected the development of the telecommunications market. The dot.com bust forced some of the operators to focus their activities on their core lines of business and geographical markets³⁵. Thus, their diversification plans were not implemented. Secondly, many of the alternative operators faced day-to-day problems that prevented them from gaining access to public infrastructures that would enable them to build their own infrastructures. Several of the administrations (roads, railways, local communes) were not aware and not accepting the fact that the market had been liberalised and quite naturally continued to inform only their former colleagues in EPT about planned civil and infrastructural works. While the situation gradually improved, it was only with the creation of LuxConnect that this barrier was overcome.

Since 2004 the development of the ICT sector in Luxembourg has attracted considerable attention from the government in general and the Minister of Communications in particular. International consultants were hired to assess the state of play across the sector, discussing with a wide array of stakeholders. These discussions showed that, whilst the mobile market was operating competitively, the fixed market was still largely dominated by the incumbent (ILR, 2004). In particular, international broadband connectivity and access to the main Internet peering points found to be problematic (ILR, 2004). The government initially increased pressure on EPT but soon took the completely unexpected decision to create a second state-owned operator to stimulate competition - LuxConnect was created in 2006 to address, at least partially, the problems that were being experienced (LuxConnect, 2013). The creation of LuxConnect has stimulated competition in terms of network infrastructures and datacentre capacity and has allowed several national and international players to offer services to enterprises. It has also attracted many international e-commerce and game providers to establish technical infrastructures in Luxembourg. The impact of this should not be underestimated: substantial tax revenues and employment in the ICT that now accounts for 7% of the country's GDP. In 2010 Luxembourg defined ambitious goals for developing its ultra-high bandwidth³⁶ infrastructure, (SMC, 2009), and asked EPT to build a nationwide FTTH network. However, during the course of 2012 it became clear that the given objectives could not be achieved and an alternative plan was sought. The current suggestion is to use the network infrastructure of cable TV operators in the north of the country where population densities are lower.

According to a OECD study (Greenstein & Mcdevitt, 2012), which tried to measure the effects of broadband connectivity, Luxembourg appears to have done relatively well in offering high broadband connectivity at attractive prices. In addition, the market has grown considerably since 1997 in terms of both absolute value and in terms of the number of market participants. Luxembourg is well connected to the main international Internet hubs, and is able to offer broadband access to all of its population. The country also contains high quality data centre capacity and is about to rollout next generation networks (LTE and FTTH).

Some of the larger international or global operators have been interested in Luxembourg because of their home customers often have a subsidiary or a local

³⁵ See, among others, (Fransman, 2002) for a discussion of the dot.com bust.

³⁶ 100 Mbit/s to every household

operation located within the country. Even before telecommunications market liberalisation commenced, British Telecom, for example, was present in Luxembourg through a small local sales office relying on the infrastructure provided by EPT. During the initial phase of market liberalisation, that is, from 1998 to 2001, many international players showed some interest in developing their activities in Luxembourg and about 20 licences for fixed network services were awarded in 1999 alone (ILR, 1999). Thus, operators like Global One, WorldCom and KPN established operations in Luxembourg. Unfortunately, the .com bust (Fransman, 2004) at the turn of the millennium forced most operators to focus on their home markets and thus abandon their presence in Luxembourg.

Only WorldCom, which later became Verizon Communications, remained with a datacentre offering hosting and disaster recovery services to mainly financial institutions. When LuxConnect started its operations in 2009, some of the operators that had left around the turn of the millennium returned so that currently KPN, Level3, Verizon, BT, AT&T, Colt Cable&Wireless, Cogent, Interoute, Telefonica, T-Systems have sales offices in Luxembourg. Having said this, only Verizon has its own datacentre and own fibre connectivity to and from Luxembourg.

In 2006 Belgacom expressed an interest in Luxembourg and started to invest in Telindus. They later acquired Tango, the country's second mobile operator, and in 2011 transformed Telindus into Telindus Telecom to become a major alternative operator for professional customers. Tango, like Belgacom, cooperates with Vodafone as a network partner³⁷. France Télécom flirted with investing Luxembourg before finally doing so in 2010 when it acquired a mobile operator. Rebranded as Orange in 2011, they are a key player within the market offering a range of products and services³⁸. Although Telindus Telecom and Orange have deployed their own mobile network infrastructure they are also reliant on access to the infrastructures operated by LuxConnect and EPT.

How competitive ICT markets are is often measured through composite indices. One such index is the Global Information Technology Report that is published by the World Economic Forum and which, to a lesser or greater extent, focuses on how ICT enhance competitiveness (Bilbao-Osorio, Dutta, & Lavin, 2013). If we examine these indices then we find that in recent years Luxembourg has performed well, thereby suggesting that the evolution of the market described above has increased the country's international ICT competitiveness. However, this has been achieved through mass state intervention, especially on the supply side, with LuxConnect playing a central role. This inevitably raises the question as to whether this intervention will continue in the future, especially given the budgetary pressures being faced by the government. The rollout of the FTTH infrastructure is not yet complete, and has attracted a relatively small number of subscribers in the south of the country³⁹. These developments cast doubt on the future development of this infrastructure.

³⁷ Vodafone has extended its geographical coverage through signing Network Partner Agreements with a range of operators. Operators agree to collaborate with Vodafone in terms of international roaming and often co-brand their operations to include the name Vodafone.

³⁸ See www.orange-business.com for further information.

³⁹ End of 2013, only 12000 subscribers have opted to use the FTTH infrastructure that is being rolled out.

The focus on high quality, highly reliable, Tier IV, datacentres has also created its own problems. Quite simply, there is over capacity to the extent that some of the recently constructed datacentres are not being fully used (Henry, 2014b). Moreover, the emergence of cloud services has changed the market, with customers increasingly demanding simpler services that are not tied to a single underpinning infrastructure. In other words, customers are demanding services that are available wherever they are not just where the physical infrastructure is located.

9. Conclusion

This paper has sought to chart and then explore the degree and forms of actually existing market liberalisation that has occurred within the Luxembourgish telecommunications market. We have demonstrated how the state has continued to play a key role within this market. If we return to the four questions that we asked at the start of the paper, what conclusions can we draw?

The first question asked whether the market in Luxembourg displays the features of a competitive marketplace. Looking at the above it can be concluded that the market has witnessed only a limited degree of market liberalisation. EPT is still the dominant player across much of the market. Having said this, the overall size of the market has grown substantially during this period of neoliberal experimentation.

The second question asked how the intervention of the government has shaped the market? The government has undertaken substantial supply side intervention and made significant investments that have resulted in a network duopoly where the state competes with itself. Given this, it can be argued that Luxembourg is indeed a bastion of state ownership, as the government has not followed other European countries to reduce both its ownership and intervention in the telecommunications market.

The third question asked whether Luxembourg would be able to keep its current competitiveness in the international ICT environment? Luxembourg has a good ICT infrastructure and international connectivity as well as substantial datacentre capacity. Local customers are presented with attractive triple and quadruple play offers, nationwide xDSL and 3G availability. Luxembourg is well positioned on many of the international ICT indices and enjoys a good international ICT competitiveness. In that sense, the Luxembourgish situation seems to confirm previous findings from countries like Cyprus in that liberalisation is not necessarily the right answer for small economies. However, further research is required to establish the importance of non-infrastructure related factors like, for example, access to finance, access to ICT skills, the impact of research and development and how it may be encouraged and so forth.

The final question asked whether international operators have invested in the local market? So far, Luxembourg has not been able to attract much in the way of foreign investment and when investment has occurred it can be argued that it was mainly for tax reasons. This raises a significant question, namely, what will happen once these fiscal incentives are reduced in 2015? Will the government seek to compensate for their removal by extending its commitment to the sector through, for instance, continued investment or will the investment in infrastructure that has occurred begin to attract (foreign) investment and thus generate economic activity?

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Figure 1: Luxembourg



Table 1: Households with PC and Internet access (%)

Year	2005	2006	2007	2008	2009	2010	2011	2012
Households with PC	75	77	80	83	88	90	92	92
Households with Internet access	65	70	75	80	87	90	91	93
Broadband (DSL, fibre, CATV)	52	63	77	76	82 ¹	78	75	73
Analogue/ISDN dial-up	51	36	26	24	20	30	27	22
DSL line	49	59	76	74	79	70	63	61

Note

1. The regulator adopted its approach to counting CATV customers to 'active users only'. This change explains the decrease in the penetration of broadband access.

Source: Statec, ILR

Table 2 - Size of the ICT Ecosystem - main indicators

Main indicators	2001 ⁴⁰	2008	2009	2010	2011	2012	2013
Companies	1797	1517	1594	1680	1750	1825	1920
Employment	11308	13626	13651	14269	14760	15200	16000
Share of total employment		3,9%	3,8%	3,5%	3,7%	4,0%	4,2%
Turnover (in million Euro)	5785	6537	6745	8771	N/A	9500	N/A
Added value (in million Euro)	1846	2264	2196	2600	N/A	2840	N/A
Added value (% of GDP)		6,87%	N/A	7,3%	N/A	6,6% ⁴¹	N/A

Sources: Eurostat, EU, Statec, authors' calculations, paperjam

⁴⁰ Based on Nace 1.0 classification

⁴¹ EU -27 mean value 4.6%

Table 3: Major milestones since liberalisation

Year	Development	Comment
1987	European Commission publishes its Green Paper to initiate liberalisation reforms all over Europe	Initial goal was the creation of a common market for services and equipment
1990	EC Directive 90/388 requesting member states to open up telecommunications services for competition	Separation of operator and regulator became necessary
1992	Entreprise des Postes et Télécommunications (EPT) is created ¹	Change from public administration to a 100% state owned company
1992	Ministry of Communications is created	Takes over regulatory activities from former P&T administration
1992	Luxembourg gets connected to the internet	Internet access for schools, teachers and some government agencies ²
1993	Launch of LUXGSM, EPT's mobile 2G network	Replacement of existing BENELUX analogue network
1995	Launch of dial-up internet services by EPT	Internet access becomes available to the general public
1997	Luxembourgish law on liberalisation of telecommunications	Defines universal service, rules of competition and interconnection, creates independent regulator
1997	Creation of Institut Luxembourgeois des Télécommunications later Institut Luxembourgeois de Régulation (ILR)	Takes over regulatory work from Ministry of Communications which is disbanded ³
1997	Second mobile licence awarded to Millicom SA ⁴	Beauty contest approach
May 1998	Second mobile operator starts operations under the brand name of Tango	
July 1998	Fixed network market officially liberalised	All procedures in place in December only
1999	Dot.com boom 19 licences awarded to alternative operators	
2000	Introduction of new numbering plan, first Reference Unbundling offer, trials with Wireless Local Loop and Powerline technologies ⁵	
2001	Dot.com bust consolidation and drop-outs	No new operators, year of stagnation
2002	3 Mobile licences for 3G networks awarded to EPT, Tango and Orange Fir	No candidate for the 4 th available licence
2003	4 th Mobile 3G licence awarded to Luxcommunications SA Broadband Internet access via ADSL by EPT became saw great success First official statistics about the local telecommunications market became available	Later called Voxmobile
2004	Orange returns its 3G licence, VoxMobile was awarded a 2G licence, many specific service providers appeared	
2005	New regulatory framework was put in place transposing the new EU set of directives	
2006	Second state owned operator LuxConnect ⁶ was created	It was hoped that this would stimulate competition, major investments in international

	<p>EPT started to build Teralink⁷ its own international backbone network</p> <p>EPT acquires 100% of European Business Recovery Center</p> <p>The fourth 3G licence was split into two and awarded to Luxembourg Online⁸ and Astralis a joint venture between SES and Artelis⁹</p> <p>The city of Luxembourg and EPT launched a city-wide WLAN network¹⁰</p> <p>Belgacom enters Luxembourg market by acquiring the country's largest ICT integrator Telindus¹¹</p>	<p>connectivity and data centres were made</p> <p>None of the two licensees went into operation</p>
2007	<p>Mobistar, the Belgium arm of Orange acquired Voxmobile</p> <p>Luxembourg Online and Broadcasting Centre Europe were awarded a WiMax licence in the 3.5 GHz range</p>	<p>First time that a global operator committed to major investments in Luxembourg</p> <p>Has not gone into operations so far</p>
2008	<p>Belgacom acquires Tango (2nd Mobile Operator)</p> <p>EPT invests into ICT integration business and acquires Netcore</p>	<p>Belgacom now present in fixed and mobile market</p>
2009	<p>LuxConnect opens its first datacentre and international back-bone network</p> <p>LU-CIX, a privately owned internet peering point established¹²</p>	<p>Soon to be merged with Restena</p>
	<p>EPT started to invest into Next Generation Network (NGN) and fibre to the home (FTTH) technologies</p>	
2010	<p>Ultra-high broadband access strategy published</p>	<p>EPT is charged with execution</p>
	<p>LuxConnect opened second data centre and developed LuxCloud to start offering cloud services</p> <p>EPT opened its 3rd and 4th datacentre</p>	
2011	<p>New EU "telecom package" transposed into Luxembourgish law</p> <p>EPT started to commercialise "LuxFibre" up to 100 Mbit/s FTTH service</p> <p>Telindus (Belgacom) converted into a telecommunications operator "Telindus Telecom"</p>	
2012	<p>Orange and Tango start offering LTE 4G services</p> <p>Ministry announces its intention to build a TETRA network and publishes a call for a public-private partnership.</p> <p>EPT opens its 5th datacentre</p> <p>LuxConnect opens its 3rd datacentre</p>	
2013	<p>Telindus Telecom and EPT respond to the call of PPP for the Tetra Network</p> <p>Ultra High Broadband Strategy is revised and potentially adapted</p> <p>EPT announces rebranding and major restructuring in June</p> <p>Minister of Economy announces a "Marshall" plan claiming to invest over 1.000 mio Euro in Telecommunications infrastructures in the next 5 years</p> <p>EPT announces LTE launch for the end of the year</p>	<p>Won by EPT in December 2013</p> <p>CATV operators are asked to participate</p> <p>EPT gets the major part of these investments</p> <p>Commercial roll-out starts in December 2013</p>

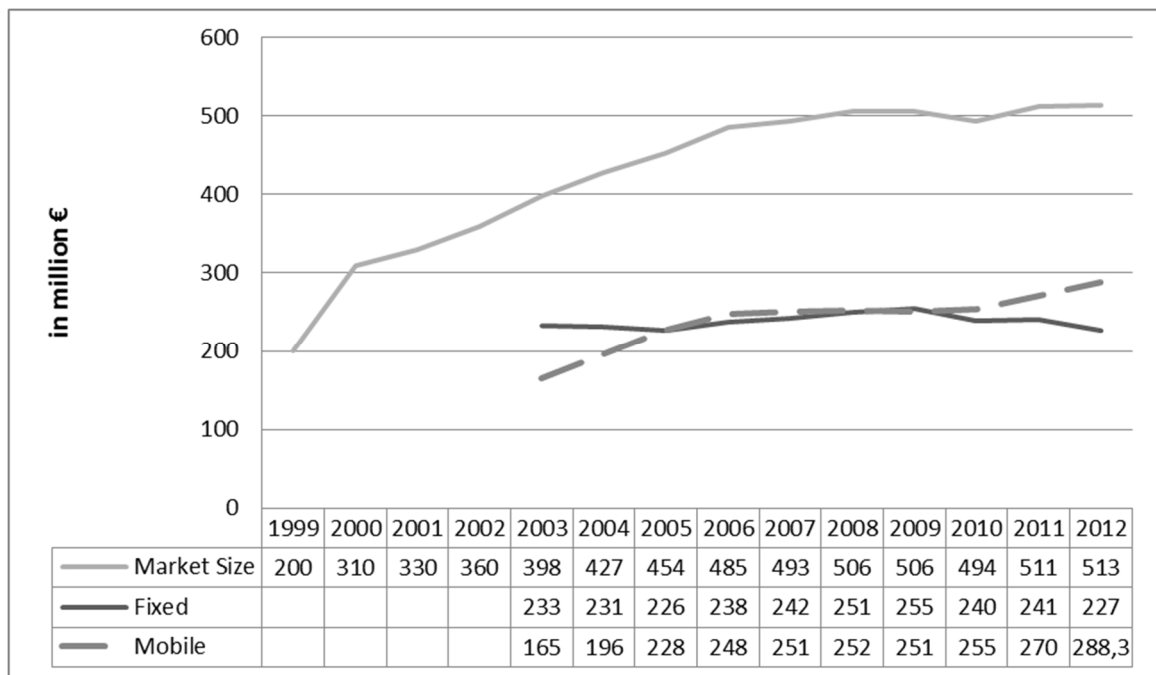
	The 4 th LTE/UMTS licence is awarded to Blue Communication who announced the creation of Join Experience ó an MVNO on EPT's mobile network ¹³	EPT holds a 50% share of this venture
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Notes

1. For additional information regarding EPT see www.pt.lu, accessed 16.2.2013
2. See www.restena.lu, accessed 16.2.2013
3. There remains, however, a Minister in charge of communications and a Service des Médias et de la Communication.
4. See www.millicom.lu, accessed 16.2.2013
5. For a comparison of the technologies see, for example, Fornefeld, Delaunay Elixmann (2008).
6. For details of the company see www.luxconnect.lu, accessed 16.2.2013
7. For details of the company see www.teralink.lu, accessed 16.2.2013
8. For details of the company see www.internet.lu, accessed 16.2.2013
9. For details of the company see www.artelis.lu, accessed 16.2.2013
10. See www.hotcity.lu for more details, accessed 16.2.2013
11. See www.telindus.lu for more details, accessed 16.2.2013
12. See www.lu-cix.lu, accessed 16.2.2013
13. See www.joinexperience.com accessed on 14.12.2013

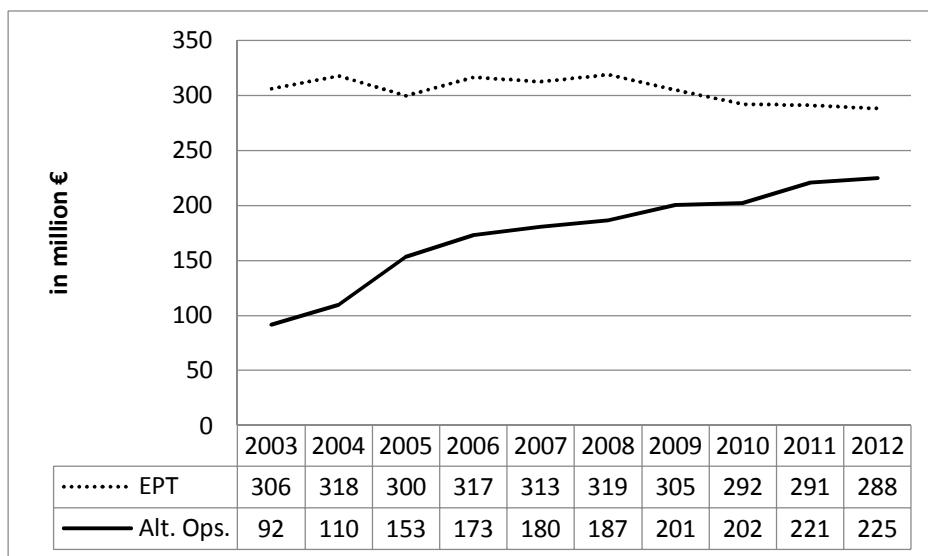
Sources: ILR, EC, SMC and authors' interviews

Figure 2: Market size (in million) and revenue split between fixed and mobile



Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation

Figure 3: Market share of incumbent versus other operators



Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation

Table 4: Major developments of EPT

Year	Development	Comments
1842	Creation of Public Post and Telecommunications Administration	
1992	Creation of "Entreprise des Postes et Télécommunications"	A 100% state owned enterprise
1993	Launch of LuxGSM - the first 2G mobile network	Replacing the old "Benelux" wide analogue system
1994	Launch of "integrated services digital network"	Migration of analogue fixed line to digital fixed line
1995	Launch of "Dial-up" internet access	
2001	Commercial launch of broadband internet access	LuxDSL
	Launch of General Packet Radio Services	Mobile data access
2003	Launch of 3G UMTS network	
2005	Launch of "integral" first "triple-play" offer	
	Launch of Blackberry services Launch of Public WIFI hotspots	In cooperation with Vodafone In major hotels and public places
2006	Teralink	International high speed fibre connectivity
2007	Inauguration of EBRC second data centre Pilot Project for IP-TV	
2008	Commercial launch of IP-TV services	
2009	Participation in Lu-CIX	Commercial internet peering point
2010	Fourth Data centre opened 3D and HD TV services offered	
2011	Launch of Ultra-high bandwidth Internet access	Luxfibre
2012	5 th Datacentre opened First Cloud services Full liberalisation of postal services on the 1.1.2013	

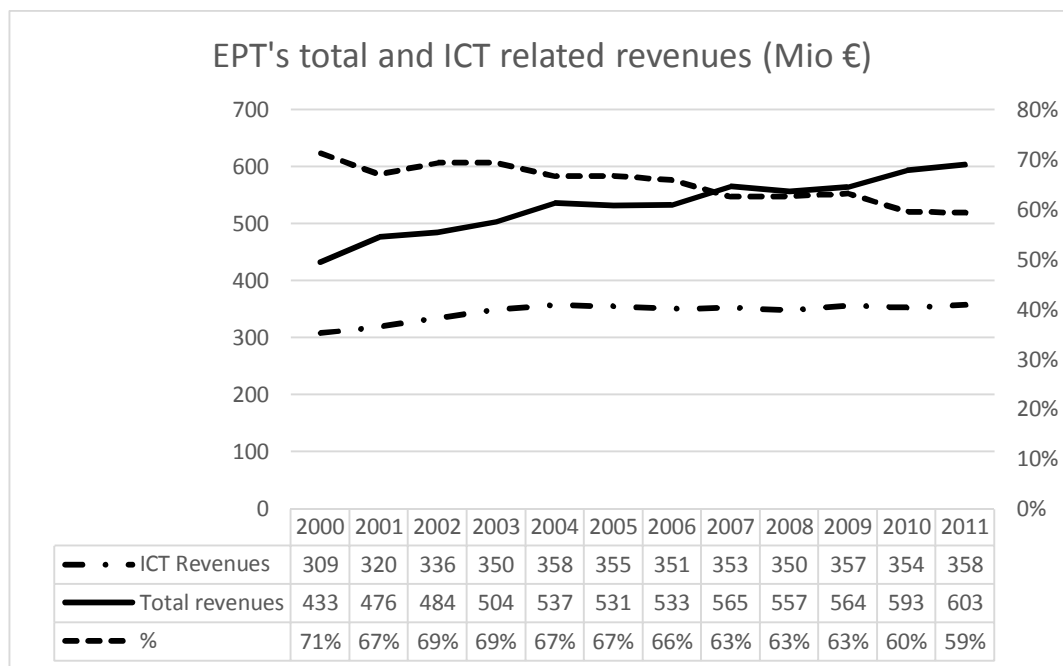
Sources: compiled by the authors from EPT's web site and a variety of sources

Table 5: Subsidiaries of EPT

Company	Activities	Stake
Ebrc	Datacenter and Business Resilience Services	100%
P&T LUXGSM	Sales of Mobile and Fixed Communications	100%
P&T Consulting	Software Development	100%
Netcore	ICT Integrator	100%
Luxembourg e-archiving	Electronic archiving services	100%
Victor Buck Services	Printing and Financial reporting	90%
Editus	White and yellow pages and databases	89.92%
Michel Greco	Express delivery of mail and small parcels	60%
Infomail	Distribution of advertising material	55%
Visual Online	Internet Service provider	51%
TNT Express	International express and courier services	50%
Hotcity	Public WLAN in major cities	49%
Eltrona	The country's largest CATV operator	34%
Regify	Secured Email	11%

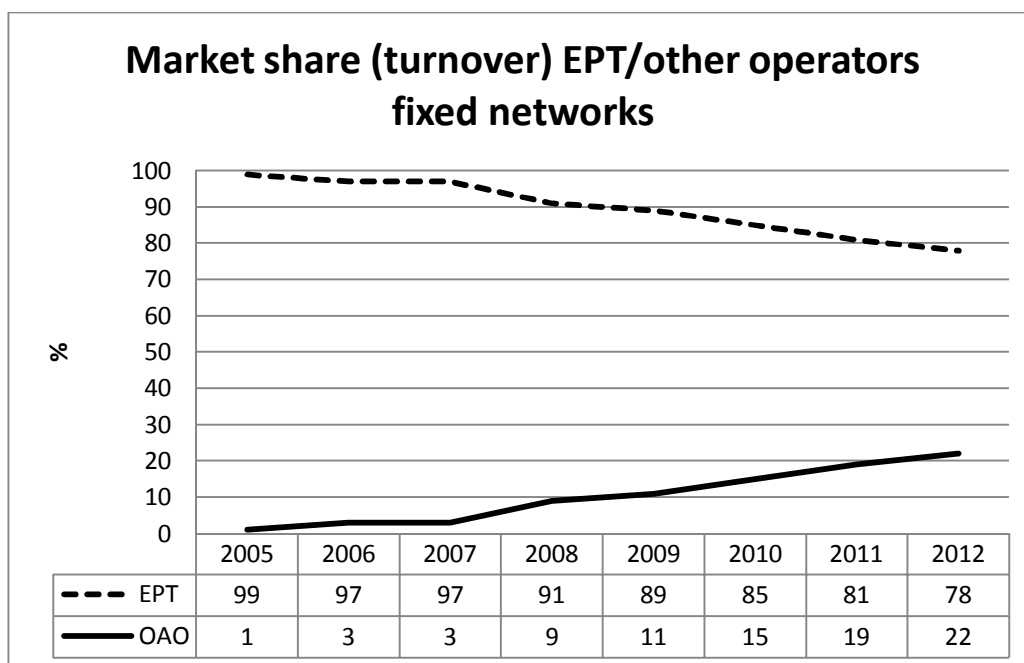
Source: compiled by the authors from the annual reports of EPT and a variety of websites

Figure 5: ICT versus total revenues for EPT



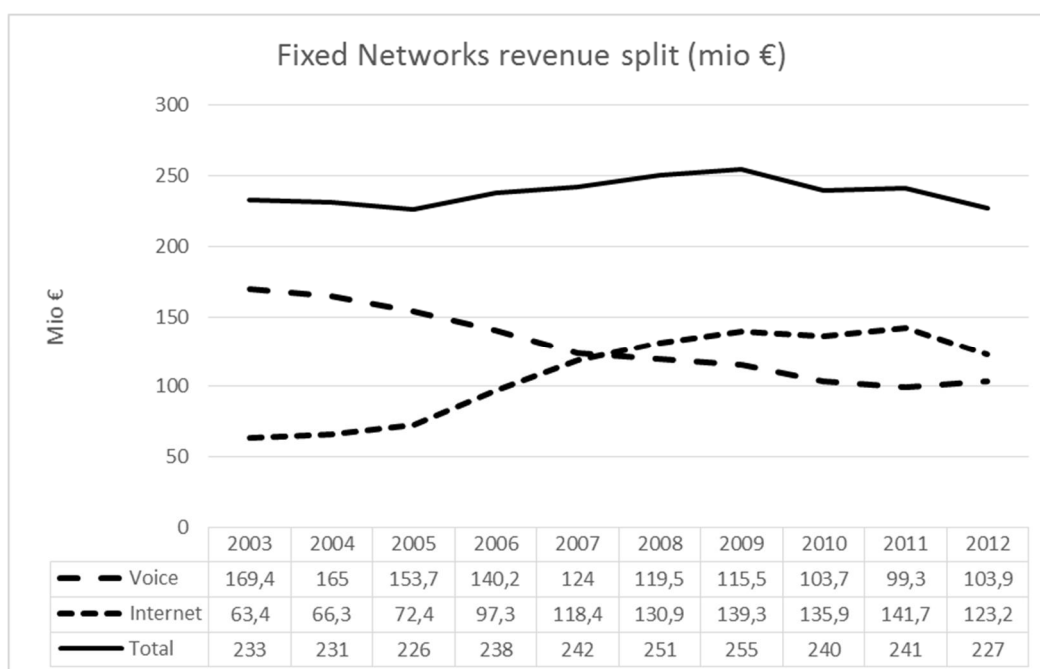
Source: compiled by the authors from EPT's annual reports

Figure 8: Market share of EPT and other operators



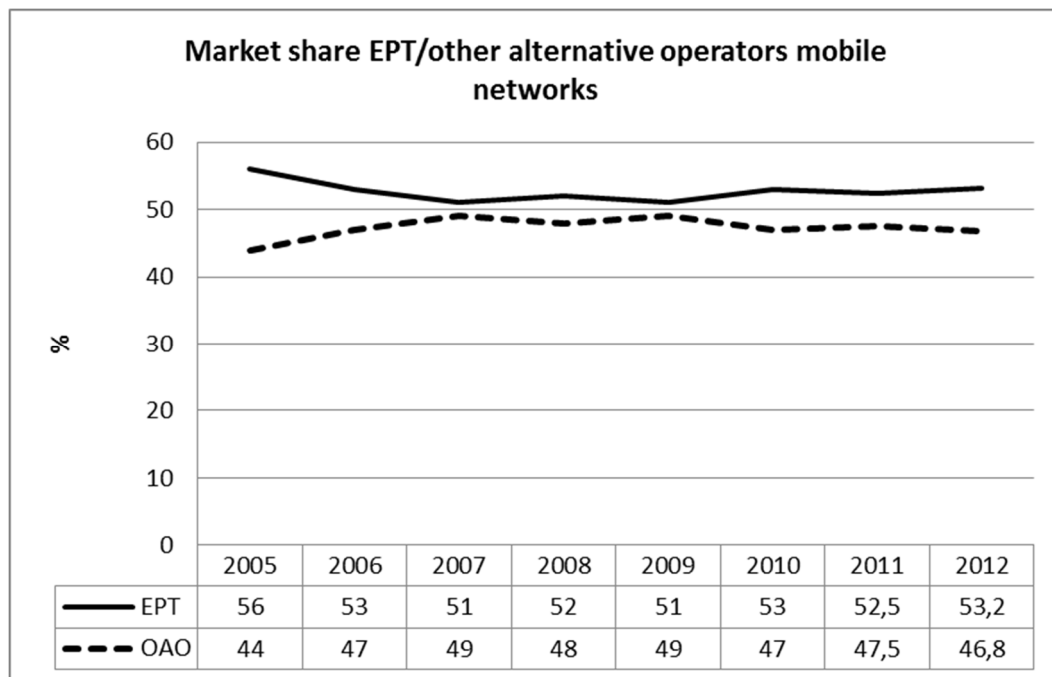
Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation

Figure 9: Changing nature of fixed network revenues



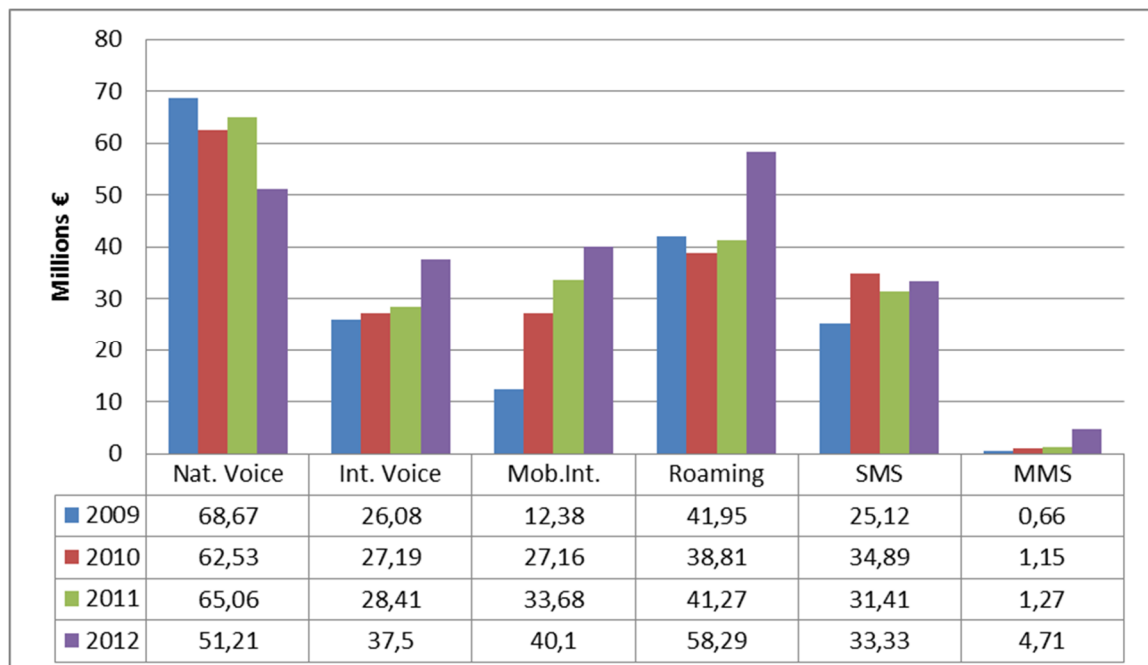
Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation

Figure 10: Competition in mobile networks



Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation

Figure 11: Mobile revenue split



Source: compiled by the authors from the annual statistical reports of Institut Luxembourgeois de Régulation