

Evolving technologies, competition and the new role of regulation: introduction and synopsis of the book

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Regulation of the telecommunications industry has traditionally focused on the supply side of the industry, chiefly the retail segment of the market. Since liberalization of the industry has begun, regulation has gradually shifted to the wholesale segment of the market. The regulatory agencies have intervened to regulate access and facilitate entry and, hopefully, investment in infrastructure. This asymmetric regulation has had mixed results. As an answer to that some regulatory agencies have abandoned wholesale regulation (the case of the USA) and some others have shifted from light-handed regulation to heavy-handed regulation with mandatory unbundling of the local loop (the case of Australia). Other regulatory agencies have moved to a more gradual type of wholesale deregulation on the grounds that competition in this segment of the market has not yet fully developed, but as it grows the need for regulation is reduced (the case of Europe and Canada).

Paradoxically, as competition increases in the retail segment of the market, consumers are increasingly 'impaired' in their capacity to make decisions in their best interest. The array of services and suppliers that competition makes available increases consumer choice and with it the difficulties for them to make rational decisions with respect to services, quality and prices, and so on. If consumers are able to make rational decisions, competition among new service suppliers will increase. But if consumers are unable to make rational decisions because of too much choice or poor quality of information or misinformation, competition is dampened and the competitive process is jeopardized. In that context, regulation must emphasize the demand aspects of the industry and consumer protection should become a priority for the regulatory agencies.

Further, next generation mobile networks (NGMN) depend heavily on the existence of ubiquitous broadband (BB) connectivity, applications and content. Broadband deployment is uneven within and among

countries. Without an adequate deployment of BB technologies the economic growth of the countries is jeopardized. Apparently, regulation is one important factor determining the pace of deployment of BB technologies. The regulatory model chosen may impact positively or negatively on investment in BB infrastructure. Additionally, ubiquitous BB and mobile applications create new needs for spectrum availability and spectrum management becomes an important function of the regulatory agencies, particularly at this time of rapid evolution of the mobile technologies. The NGMNs require a new distinctive regulatory and policy framework which will deal explicitly with the issues and opportunities of the next phase of wireless technologies.

Regulation evolves and its evolution is the result and the impetus of change of the telecommunications industry structure and performance. As the industry becomes more mature and incumbents and new entrants get more familiar with the rules of the game, they become able to develop strategies which increase the value of the firm. In a competitive context telecommunications firms will invest only if their investment achieves an average return which is greater than the weighted average cost of capital (WACC). Projects with positive net present values (adjusted for specific risks) are value accretive and therefore it is worth undertaking them. They will bring more wealth to stakeholders through dividends and capital gains. In a regulatory context the investment decisions, particularly for projects of high risk (sunk investments in BB and NGMNs, for instance) may not occur or may be 'unreasonably' delayed. Thus, under specific regulatory frameworks, deployment of BB technologies may not be optimal, NGMNs may not roll out adequately or optimally, consumers may be 'impaired' or harmed; and these are not necessarily the results the regulatory authorities have sought to achieve in the first place. Regulation thus has a role in an evolving global telecommunications industry.

This was precisely the main theme of the International Telecommunications Society (ITS) 17th Biennial Conference which was held in Montreal from 24 to 28 June 2008. This book has been prepared to highlight the main arguments and the richness of ideas about the new issues which arise from the evolving structure of the global telecommunications industry and the role of regulation. The 15 papers from the conference have been peer reviewed and they meet the stringent criteria of the scientific papers and those of Edward Elgar Publishing. We are grateful to the publisher and particularly to Alan Sturmer for his meticulous work in the preparation of this volume. We also thank our colleagues and authors of the 15 chapters of this volume for having contributed high-quality chapters. As organizer of the 17th Biennial ITS Conference, Dr Gentzoglanis thanks TELUS, and particularly

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The first chapter by Anastassios Gentzoglanis and Elias Aravantinos provides an extensive review of the literature on the role of regulation in the deployment of broadband technologies. The chapter starts out with a general introduction to the role of regulation in telecommunications markets and, furthermore, as an input discusses the relationship between competition and investment. It is emphasized that this depends on the degree of competition and the development of the market. An inverted U-shaped curve is suggested as describing the implications of competition on investment. More specifically, the chapter examines whether and how broadband development can be promoted by means of regulation. Two different types of broadband competition are discussed, service-based competition (SBC) and facilities-based competition (FBC). FBC is generally seen to be the most desirable situation or goal as FBC provides a dynamic efficiency while SBC is seen to lead to static efficiency.

The chapter gives focus to the ongoing discussion as to whether the static efficiency associated with SBC can lead to the dynamic efficiency related to FBC. This is the proposition advanced by the theory of the ladder of investment (LoI). According to this theory, new operators to the market will not generally begin with investing in infrastructure but will be more inclined to enter the market using a service-based model. Eventually, such new operators will start investing in infrastructure when they acquire a better understanding of the market conditions. Regulation can facilitate this process by setting the right entry conditions, for example, by starting with a relatively low access fee which is later on increased as the new entrants settle in the market.

The chapter examines the theoretical aspects of the ladder of investment theory and also refers to papers presenting empirically based analyses of the tenability of the theory. Moreover, the chapter introduces the issue of intermodal or interplatform competition. Even though this issue is not

absent per se from the LoI theory, nonetheless, when debating LoI, there is a tendency to confine it within a single type of access network. The chapter by Gentzoglanis and Aravantinos contributes to the debate by synthesizing the main arguments pertaining to the LoI theory. In addition, the chapter underlines the fact that BB development in different countries is not the same and this is attributed to the differences in the countries' regulatory policies and the type of their initial technological infrastructure. It should be expected therefore that the implications of a LoI policy will be different for countries with basically just one type of infrastructure (PSTN – public switched telephone network) and countries with competing infrastructures (for example, PSTN and cable).

On the basis of the theoretical propositions and the empirical analyses referred to, the chapter concludes that the actual LoI policies implemented so far have not been successful, but one cannot dismiss the possibility that a LoI policy can work. This presupposes, however, that the timing is right and the policy is fine-tuned precisely with respect to the types of new entrants. Regulators should then ask: Are they first-movers or second-movers? But this sets very high requirements on regulation.

In the second chapter, William Taylor discusses the nature of intermodal competition and its implications for regulation of wholesale services in the context of the US, but given the ubiquity of intermodal technologies, the conclusions of his analysis can find a wider application. Taylor notes that demand for wholesale services is a derived demand, in the sense that wholesale services can be considered 'essential' in the provision of retail services in the downstream market. Competition among retail service providers may curtail retail prices but there is a likelihood of anticompetitive conduct when the incumbent local exchange carrier (ILEC) is not regulated in the form of mandatory unbundling and provision of essential wholesale services at regulated prices.

When competition is fierce among dependent wireline competitive local exchange carriers (CLECs), their returns in the retail market cannot be higher than normal and therefore the ILEC monopolist of wholesale wireline services cannot behave anticompetitively and charge high prices for its essential wholesale services. Since it cannot exercise its market power at the wholesale level, its profits will also be normal. This may have some undesirable effects on investment in infrastructure. The mandatory unbundling of ILEC facilities at regulated rates would reduce the incentive of retail wireline competitors to invest in their own network infrastructures and compete on an end-to-end basis. At the same time, the requirement that ILEC facilities be shared with competitors reduces the ILEC's incentives to introduce and roll out that infrastructure, particularly for services associated with investment that will, eventually, be sunk.

Further, Taylor casts doubts about the necessity of price regulation at multiple stages of production (wholesale and retail). Using examples from the US, he demonstrates that regulation at the wholesale and retail levels becomes a source of unintended consequences in competitive markets. Thus, where intermodal competition is present the ILEC's capacity to exercise its market power is nil and therefore customers cannot be harmed. Accordingly, *ex ante* economic regulation cannot lead to an increase in social welfare and there are not any efficiency arguments that can justify the presence of economic regulation at the wholesale level. In the absence of an *ex ante* wholesale regulation, customers can be protected from competition authorities which will respond *ex post* to specific complaints of anticompetitive behavior on behalf of ILEC. Thus, where intermodal competition exists, *ex post* regulation is a better vehicle to protect customers than *ex ante* regulation.

In the third chapter Martyn Taylor delves into the question of how to strike a balance between competition, investment in infrastructure and regulation. Using the conventional financial framework for project appraisal, Taylor argues that the returns that a firm expects to get from investment in infrastructure are constrained by market conditions (consumers' willingness to pay), the presence of substitutable services (wireless broadband, for instance) and regulatory policies. These factors increase the perceived risk of the investment in next generation networks (NGNs) and the latter will not materialize unless a firm has reasonable certainty that it will earn a return that exceeds its cost of capital over the project's life.

Taylor argues that well-intended regulation can have unintended adverse effects, chiefly by providing disincentives to investment due to an increase in perceived risks particularly when regulation is asymmetric. Network unbundling and cost-based access regulation are two cases in point. While they contribute to allocative (static) efficiency by increasing the level of competition to which incumbent network owners are subject, they may do so at the expense of long-term investment incentives. The total element long-run incremental cost (TELRIC) approach has been used in the US and its variant – total service long-run incremental cost (TSLRIC) – in Australia as a mechanism to regulate prices based on the incremental costs faced by an efficient cost-minimizing firm with an optimally configured network that uses the best available current technology. Under the TELRIC approach, any investment in network infrastructure would simply earn enough to cover the project's weighted average cost of capital (WACC), bringing thereby the net present value (NPV) of the project near zero. The firm would not have an incentive to invest in infrastructure and the desirable long-term effects of dynamic competition are sacrificed. This was the case with Australia which has applied excessive regulation

using the TSLRIC approach. The application of TSLRIC pricing by the Australian Competition and Consumer Commission (ACCC) has deterred investment in infrastructure and investment flows have been distorted away from regulated (and potentially regulated) services towards unregulated services and infrastructure. The negative effects of excessive regulation are illustrated by the example of failed negotiations between Telstra (Australia's incumbent telecommunications carrier) and the Australian government when the former was seeking exceptions from the current regulation in order to implement fiber to the node (FTTN) upgrade investments. Telstra's withdrawal forced the government to intervene and proceed with the investment in partnerships with the private sector. Taylor suggests that policies such as access holidays and public-private partnerships (PPPs) may be some interesting techniques to provide incentives to firms to invest in NGN infrastructure.

Patrick Xavier and Dimitri Ypsilanti's chapter (Chapter 4) examines the demand side of the telecommunications industry. Since liberalization, the number of new entrants in telecommunications markets has increased considerably and service competition has grown significantly. In this context, Xavier and Ypsilanti believe that the consumers' rational decision-making mechanism is seriously impaired amidst the plethora of services and packages offered by the telecommunications firms. This contrasts with the neoclassical view of consumer behavior according to which consumers are able to make rational decisions and choose, all the time, the goods and services which maximize their utility. In reality, consumers' behavior departs significantly from the traditional rational behavior assumed by the conventional neoclassical economic theory. By using the behavioral approach to consumer behavior and statistical examples, the authors demonstrate that consumers choose telecommunications services for a number of reasons which may not be characterized as a 'rational' behavior in the sense of classical theory. For instance, consumers are discouraged from switching to a different service provider because of the perceived or real high switching costs (lengthy and cumbersome switching procedures; early exit charges; confusing products and non-transparent pricing; technical incompatibility of equipment; long-term deals that lock consumers into lengthy relationships with their providers).

The barriers to switching service providers can also have an impact on the supply side of the industry. New entrants could be deterred from entering the market, fearing that they will be unable to persuade customers to switch from their existing provider. 'This could diminish contestability and the effectiveness of competition and limit the benefits that consumers would otherwise derive from it', say Xavier and Ypsilanti. The statistics from various countries (the UK, Portugal, Australia and the US) and

from various segments of the market (fixed line, mobile and Internet) illustrate that competition has made the telecommunications industry quite complex (on the demand side) and consumers facing this complexity prefer to adopt consumption strategies which are not necessarily in their best interests. Indeed, consumers will prefer to stay with what they know (no switching) instead of choosing a cheaper alternative.

Xavier and Ypsilanti's analysis is consistent with the argument of behavioral economics according to which an 'endowment factor' serves to influence decisions in favor of the present provider. In that context, regulation has an important role. Regulators have to take a number of measures to assist consumers to make 'rational' decisions in their best interests. Educating consumers; increasing awareness about new services and options; requiring that all major operators provide comparable and complete information about the services, quality and prices; targeting information to most vulnerable consumers; could be some of the new responsibilities of the regulatory agencies in an era of increased competition in the telecommunications industry.

In the fifth chapter Marcel Boyer develops a methodological framework which is used to characterize properly the level of competition in the telecommunications industry, particularly in the residential local access market. He argues that failing to recognize and properly evaluate the nature of competition in the telecommunications industry may lead to an inefficient use of regulation. In competitive telecommunications markets, regulators play a new role and must undertake three new functions, acting as: generators of information for the consumers; managers of the rules of competition among telecommunication players; and promoters of efficient investment programs.

Boyer argues that the telecommunications industry has changed dramatically from the mid-1990s onwards and the technological changes have made it appear much more like an emerging industry than a mature industry. Therefore, the traditional measures used to determine the level of completion in the industry are less relevant. New measures must be used to determine the level of competition in the industry. For instance, the use of market shares as an index of competition may make sense in mature industries where there is a relative stability of market conditions, but applying it to the telecommunications industry characterized by a rapid pace of changes may be misleading. Further, even though the pricing schemes used by competitors are differentiated so that switching among service providers becomes difficult on the part of consumers, the lack of switching does not make the telecommunications markets less competitive. On the contrary, the very existence of price differentiation indicates that the telecommunications industry is indeed competitive. Without it, prices

would have been quite low, making the provision of new services a losing opportunity inviting exit from the industry and an ultimate reduction in the number of firms in the industry (less competition).

Although competition may be limited in terms of prices, telecommunication service providers may compete in a number of other areas, such as coverage, type of transmission (digital or analogue); interplatform provision of services (DSL – digital subscriber line; cable modem), security, and so on. Therefore, traditional measures of measuring competition such as relevant market, relevant (substitutable) services available to consumers, relevant set of actual or even potential competitors, and so on, are less relevant during this changing phase of the telecommunications industry. In that context, Boyer proposes a different regulatory mechanism. He argues that, to achieve a proper balance between static (short-term) and dynamic (long-term) goals, regulators must rely on competitive processes, in a sense that instead of micro-managing prices and quantities, they must make sure that these prices and quantities emerge from a competitive environment. Thus regulators have an essential role: they have to act as efficient generators of social efficiency by safeguarding the competitive process in the telecommunications industry. This is achieved by making sure that inter-access to essential facilities is available at non-discriminatory conditions and prices so that only new, more efficient entrants enter the industry. In that way, consumers benefit from the entry of efficient competitors. Thus, viewing the emerging structure of the telecommunications industry as a process, regulators must act as: (1) trusted generators of information for consumers; (2) managers of fair conditions for access to the local loop; and (3) promoters of investment programs which should contain pricing rules designed to include all network access costs and guarantees safeguarding the integrity and reliability of the entire network.

The sixth chapter, contributed by Kenneth Jull and Stephen Schmidt, intends to offer an alternative framework that can be used as a basis for new approaches to the regulation of the telecommunications industry. The authors make a distinction between *ex ante* and *ex post* regulation and they use examples from other industries to illustrate that *ex post* regulation can be an option for the telecommunications industry. Traditionally, the regulatory systems in the telecommunications industry have been *ex ante* systems, but the latter are increasingly criticized as inefficient since they are perceived as being a blunt ‘one-size-fits-all’ mechanism. In Canada, there are suggestions (Telecommunications Policy Review Panel) to replace this mechanism by a new regulatory framework which would set out broad principles to prohibit anticompetitive conduct instead of detailed *ex ante* rules.

Jull and Schmidt propose three principles that ought to govern the balance between *ex ante* and *ex post* systems in the application of the regulatory policies. According to them, regulators focus ought to be on: (1) the prevention of harm and attainment of specific social objectives; (2) strategies for managing risks; and (3) the adoption of flexible mechanisms (use of multiple models) to reflect the different needs of the stakeholders.

Each system, being *ex ante* or *ex post*, might have two subsets within it, being rules-based and principles-based. A rules-based system (whether it is *ex ante* or *ex post*) is better suited to industries which are stable, technologically simple and where the economic and financial stakes are relatively low. The telecommunications industry is undergoing rapid technological and market structure changes, so this industry is neither simple nor stable and the economic stakes are very high. Because rules are inflexible, they can be overtaken by changing circumstances in fields such as telecommunications. In such a context, a principles-based approach may be more appropriate. As a matter of fact, the choice between principles-based and rules-based systems is a function of social and economic priorities and the level of maturity of the industry. Rules-based systems are more suitable for cases of *social regulation* where serious harm may be prevented whereas principles-based systems are generally more suitable for cases of *economic regulation*. Jull and Schmidt propose the same type of regulation for the Canadian telecommunications industry as the one proposed by Boyer in Chapter 5 but each author draws his conclusions using a different analytical framework.

The seventh chapter by Olaf Rieck analyzes, from the industry's perspective, the strategic activities of the telecommunication carriers to integrate vertically the various segments of the value chain. Few studies examine quantitatively the new strategic directions that telecommunication firms take in the rapid changing environment, and Rieck's study falls into this category. He divides the telecommunications industry into five layers and then uses Fransman's (2007) value chain simplified layer model to assess empirically the impact of various strategic initiatives on the valuation of telecom operators. Rieck is interested in the evolution of the structure of the telecommunications industry and in the strategies of industry players to extend their market power to more layers. This is quite interesting when one views the recent changes in the telecommunications industry structure and its trend to convergence.

Nowadays, the telecommunications industry has many firms which entered from outside the traditional telecommunications services industry, and many are quite new or did not even exist back in 1998. For instance, Google emerged as world leader for online searches and has established itself as a significant player in the telecoms value chain. Google is also

involved in the roll-out of broadband infrastructure and the provision of content. Apple launched the iPhone which threatens various traditional players in the value chain. By offering hand phone devices, Apple has effectively become a new player in the hand phone equipment market (Layer 1). By tying Apple's handsets to iTunes (Layer 4) and by striking content deals with content providers (Layer 5), Apple has extended its market power in almost all layers of the value chain. Nokia and Sony Ericsson have followed Apple's lead by launching their own content platforms. Traditional telecommunications carriers, while under threat from all sides to be reduced to 'bit-pipes', have tried to counter the threats by engaging in activities in vertically related markets. This includes initiatives like joining the open handset alliance, the development of mobile portals, or striking deals with content providers such as to strengthen their position in the content integration layer. Do these strategies help to increase the telecommunications firms' reach and market power, or will they reduce their role in the future? Rieck answers these questions by examining the reactions of financial markets to the strategies adopted by the telecommunications companies, particularly Mergers and Acquisitions (M&A), after rival firms have announced their decisions to extend their reach in the vertical value chain of the industry.

Chapter 8, authored by Bronwyn Howell, asks the question whether an industry-specific regulatory regime (a telecommunications regulator) is more able to pursue an economic efficiency (static and dynamic) objective than a competition authority (non industry-specific) without falling into the trap of regulatory capture. To answer this question, Howell examines New Zealand's telecommunications sector in the 1990s and 2000s. She notes that the initial goal of New Zealand's government was to preserve the telecommunications industry's long-run incentives to invest in new networks and technologies using a 'light-handed' regulatory regime. Unfortunately, the objectives of regulators often do not coincide with those of politicians. The latter are subject to more pressures from vested interest groups and more inclined to satisfy their demands by adopting new and/or modifying existing legislation to pursue different sectoral objectives. Given that regulators are the agents of political principals, they may lose their power when politicians decide to change objectives and move from efficiency objectives to distributional ones, as was the case with New Zealand's government in the 2000s. Indeed, prior to the competition law review in 2000, New Zealand had adopted 'light-handed' regulation for its telecommunications sector. Despite this regulation, the telecommunications industry was far from unregulated. Under a contractual arrangement, the incumbent monopolist, Telecom Corporation of New Zealand Limited, had rural-urban universal service obligations, free local calling

and a price cap on residential services. This contractual arrangement, known as the 'Kiwi Share', was a type of regulation capable of achieving economic efficiency.

The objectives of regulation have been changed with the change of government in 2000 and the adoption of the Telecommunications Act in 2001. The Act established an apparently independent Telecommunications Commission (within the Commerce Commission) and TSLRIC pricing for 'designated services'. This creation of an apparent independent regulatory body free from risk of capture by vested interests was seen as an 'enlightened' form of industry-specific regulation. Nonetheless, its independence was tested when the Commission undertook a revision of local loop unbundling (LLU). The Commission, applying dynamic efficiency principles, decided not to proceed with unbundling. By contrast, the Commission used a different approach when it had to examine the mobile termination market where serious concerns have been raised concerning the exercise of monopoly power. In a surprising decision, the Commission asserted that the sector's objective was to pursue competition rather than efficiency, and therefore short-run objectives were prioritized. Although making efficiency an explicit regulatory objective is rationally justified from an economic perspective, viewed from a political perspective the efficiency objective is unsustainable in the long run. The New Zealand case clearly illustrates that *ex ante* regulation can be inferior compared to *ex post* regulation – competition law – particularly when the risks of regulatory capture cannot be avoided.

Scott Marcus and Dieter Elixmann contribute the ninth chapter. They argue that the migration of current networks to next generation networks (NGNs) and the issues arising from their access to the fixed network bring new challenges to regulators and policy makers alike. For instance, the use of local loop unbundling (LLU) as a solution to the problem of incumbent's market power is particularly challenged by the migration to FTTC/VDSL (fiber to the curb/cabinet/very high speed digital subscriber line) or to FTTH/FTTB (fiber to the home or fiber to the building) networks. The migration to NGNs is very different from country to country and these differences are due to the existence of various regulatory regimes and the market evolution in each country. Germany and the Netherlands, for instance, have a regulatory framework which incentivizes incumbents to be the 'first-movers' to replace the traditional fixed access network with VDSL-capable networks. In France, the NGNs' deployment has been undertaken by the incumbent as well as its competitors. In Japan, deployment is realized not by the incumbents but by other independent companies. In the US, a change in regulation in 2003 put an end to mandatory broadband unbundling and allowed broadband services to be offered over

cable. Such a policy gave incentives to incumbent operators AT&T and Verizon to make substantial investments in fiber. The authors compare the performance of each country trying to identify whether competition and/or regulation are the most important factors for change. After having analyzed in detail the level of deployment of the fiber-based NGNs and the regulatory regimes determining the access conditions in Germany, the Netherlands, France, Japan and the United States, they conclude that regulation is an important input in the deployment process of NGNs but there is no unique model of regulation which fits well to every country. Rather, a number of factors – demographic, geographic and historical (availability of alternative last mile infrastructure) – determine the formulation of the regulatory policy. Once the latter is well conceived and put into play, it is the force of competition which determines the pace of NGNs deployment. Thus, country-specific regulation and competition are the *sine qua non* conditions for a wider deployment of NGNs.

The tenth chapter is by Arata Kamino and Hidenori Fuke, and is the first of three chapters to discuss functional and structural separation and its effects on the roll-out of BB technologies and platforms and NGN applications. Their analysis is a case study of the Japanese telecommunications industry demonstrating that the deployment of BB technologies and the implementation of the world's fastest and cheapest DSL technologies in Japan are attributed to the particularities of the Japanese regulatory regime and market conditions. Indeed, Japan was one of the first industrialized countries to implement the most rigid open network policy for the promotion of service-based competition. For instance, unbundling obligations have been imposed on both copper and fiber loops and the competition that this regulation has entailed resulted in very low LLU fees particularly for shared lines. Given the rapid increase in competition in LLU, no bitstream access competition has been developed in Japan. The European Union (EU) and the US have implemented a similar type of copper LLU but they have not experienced the same degree of DSL as in Japan. Although there is no simple answer to this conundrum, the authors advance the arguments according to which the difference in performance may be attributed to the way this regulation has been applied in different countries and continents. For instance, in Japan, the LLU fees were fixed at an extremely low level favoring service-based competition by new entrants. In addition, the Japanese entrepreneurs may be driven more by a kind of 'animal spirit' which contributes to intensify competition even when profits are not as high as they could be. Indeed, Japanese DSL competitors continued to provide very cheap alternative DSL services despite long-standing fiscal losses during the early 2000s. Competition is effective and works when it is fair and transparent. But it is not entirely clear

whether competition is more effective when conduct regulation is imposed on the incumbent or when structural separation is applied. Given that Japan adopted in 1999 the same level of conduct regulation as the EU, but that competition and the deployment of BB technologies have developed faster in Japan than the EU, the authors argue that Japan's structural separation was an effective means to foster competition in the market. Nonetheless, the introduction of FTTx (fiber to the x) and NGNs raises additional issues in the discussion of vertical separation in the telecommunications industry, such as the 'hold-up' and 'coordination' problems, and one should analyze the perspectives of competition which will emerge between traditional carriers and content providers on the basis of new business models before the implementation of a structural separation.

Peter Curwen and Jason Whalley continue the theme of the implementation of functional separation in Chapter 11, this time using the UK experience. In the EU, the implementation of functional separation within fixed telecommunications markets is increasingly seen as a way to resolve the tensions that exist between incumbent operators and those other service providers that require access to incumbents' networks to deliver their own services. In 2005, functional separation was implemented by the British incumbent, British Telecom (BT), after pressure by Ofcom, the regulatory authority, thereby making the UK the *de facto* European leader in functional separation. Under this agreement, BT created a new company – Openreach – to run BT's local access network. The creation of Openreach was possible after BT has agreed on a series of undertakings. Curwen and Whalley's chapter focuses on the implementation of these undertakings and highlights the difficulties encountered to make the functional separation effective. The authors demonstrate that functional separation is not a simple task. On the one hand, regulators encountered enormous difficulties in making the undertakings operational and, on the other hand, Openreach had difficulties in implementing them.

One of the major tasks in implementing functional separation is to selectively separate those parts of the network that are difficult for other operators to replicate but which they need to access in order to provide their own services. To interpret such a separation as simply a division of the incumbent's wholesale and retail businesses from one another – either in the form of accounting, corporate or type of service (local from long distance; mobile from fixed; local from broadband, and so on.) – is completely misleading. The way functional separation is defined – in a broad or narrow sense – has important implications for the actual form of separation. Regardless of the extent to which functional separation is implemented, regulators should provide incentives so that the separated network could act in the interests of all its customers, internal and

external, and not in the interest of its parent company. BT's separation was driven by the need to incorporate EU directives into the UK regulatory framework, the failure of competition to develop as anticipated in the UK, and the establishment of Ofcom in 2003, which undertook a strategic review of the telecommunications market in order to examine the level of competition of the telecommunications industry in the UK and identify the regulatory options available. Ofcom concluded that deregulation was not possible because sector-specific regulation was faster and more precise than the alternatives – competition. Ofcom opted for a functional separation called 'real equality of access' under which independent purchasers of BT's wholesale products could buy these products under the same terms as BT's own retail operations. In practice, the 'real equality of access' took the form of equivalence of outcome and equivalence of input. Under the former, wholesale customers receive products that are comparable to those offered to BT's own retail operations, but the underlying processes are different. Under the latter, wholesale customers receive the same products as BT's own retail operations using the same set of underlying processes. Despite the delays and the definition problems, the period subsequent to the adoption of functional separation has seen the emergence of significant broadband competitors. LLU played a central role in the strategies of entrants and offered incentives to other service providers to invest in other parts of the 'ladder of investment'. The emergence of LLU as a vehicle for the deployment of broadband services lifted the importance of BT in the market and made sure that the relationship between BT and those companies using its network was functioning as planned.

Toshiya Jitsuzumi is the author of the twelfth chapter. This chapter provides a theoretical justification and an econometric analysis of the hypothesis that LLU is contributing to the deployment of new technologies such as FFTx. He emphasizes the need to take into account social and economic aspects of the issues arising from the network neutrality debate, and he concentrates his analysis on the solutions that are most efficient from an economic point of view in the short term and long term. In the short term, it is assumed that entry does not occur and the market is served by the existing network operators. In the long term, entry occurs, competition is more intense and network congestion becomes a less acute issue. The proposed solutions are dependent on the assumptions made.

For instance, when the network capacity is fixed in the short run, the problem becomes one of static efficiency maximization. In that case network operators have market power and regulators have to find efficient solutions to discipline incumbents who control bottleneck facilities. But given that content providers depend on the presence of other firms in the industry in the provision of their own content, it is unlikely that they

will exercise their market power and foreclose the market from competition. Indeed, in this industry, a firm is interested in the internalization of complementary efficiencies (ICE) arising from applications created by others. This behavioral characteristic – the ICE in conjunction with the costs associated with regulation and information asymmetry – makes the competition solution a more desirable solution than regulation. Knowing that a profit-seeking bottleneck monopolist acts to maximize its efficiency, regulators should not use rules-based regulation but rather principles-based, unless there is pressure arising from the exercise of significant market power (SMP) by some service providers. ICE makes regulation less desirable and government intervention is kept to a minimum.

In the long run, the issues become more challenging than in the short run. In the long run, market conditions must be such that incumbents and new entrants have the appropriate incentives to invest in new technologies and maximize dynamic efficiency. Investments, being in the form of virtual capacity, better protocols – peer to peer (P2P), proactive network provider participation for P2P (P4P) – and/or better network management, must be financed but the problem is that, as yet, there is no any sound business model that provides incentives to stakeholders to invest in infrastructure. Network neutrality proponents suggest the use of a subscription model – that is, through additional monthly subscription revenues such as quality-of-service (QoS) surcharge from end-users – while the opponents suggest a business model according to which investment in infrastructure is financed by charging content and application providers. Neither of these models can assure the collection of sufficient revenues for capacity expansion or the quality of the transmission of the content. These solutions may be utility-decreasing and unsustainable in the long term.

In order to verify whether the subscription model is sustainable in the long run, Jitsuzumi conducted a survey of Japanese broadband users using an e-mail and web-based system. His data and econometric analysis indicate that such a business model is not sustainable in the long run unless there are positive expectations concerning the future technological developments and the existence of a fund allocation mechanism. His results are quite informative and useful for other countries.

Bruno Basalisco, Andy Reid and Paul Richards contribute the thirteenth chapter, delving into the interesting question about the effects of regulation on innovation and on evolving technologies, most of which emerge outside the domain of the telecommunications industry. Departing from the self-evident fact that the main objective of innovators is the commercialization of their innovations, they argue that such commercialization is more successful when various parties across sectors coordinate their activities. The converging nature of new technologies requires a keen

interplay between innovation and regulation and makes the latter less desirable, particularly when the boundaries of the industries are merging.

In an increasingly competitive world, erstwhile competitors realize that innovation requires more than large market shares and market dominance, it needs 'co-opetition'. The latter is used to create a competitive advantage in innovation processes involving all 'co-opetitors', that is, their network of suppliers, users and customers. Collaborative ventures with other industry stakeholders lead to greater coordination of the innovative activities and reduce the uncertainty associated with technological changes across sectors. Innovation interdependence delivers maximum benefits to their participants. The standardization of technologies through collaborative ventures and interconnectivity minimize the level of risk of the entire value chain and not just one part of it. But regulatory decisions may contribute negatively to the tendency of collaborative innovative agreements and thwart the appearance of new business models. The presence of network spillover effects in the various processes of innovation provide incentives for different networks to interconnect. Further, the presence of path-dependence in innovations implies that successful innovation by one or more player(s) is likely to influence future technological choice across the industry. Co-opetition, path-dependence, spillover effects and standardization add considerable complexity to the exploitation of network-based innovations, but reduce the risks associated with innovations in converging industries. Basalisco, Reid and Richards argue that the regulatory frameworks should be operated in such a manner that different risks associated with different innovations are treated differently in regulatory terms. Failing to recognize this means the current regulation may provide disincentives to firms to commit resources to invest in innovative activities and infrastructure.

The penultimate, fourteenth, chapter by Claudio Feijóo, Sergio Ramos and José-Luis Gómez-Barroso adopts an interesting approach to examine the impact of regulation on the pace of deployment of the next generation mobile networks (NGMNs). They argue that regulators may adopt either a stable and coherent framework which provides incentives to investment in broadband technologies, or a framework which may retard the deployment of these new technologies by amplifying all techno-economic uncertainties. According to the authors, spectrum management is one of the most important areas where regulation may have an immediate impact. Referring to the regulation of spectrum in the EU, the authors urge regulators to make spectrum management more flexible in order to be able to accommodate the next generation mobile networks (NGMNs) and other fast-evolving technologies. They also suggest a better harmonization of spectrum management mechanisms across member states for easier

deployment of ubiquitous broadband infrastructure and faster realization of the benefits of the NGMNs. Drawing from the US experience and the relative failure of the Universal Mobile Telecommunications System (UMTS) as opposed to the great success of Global System for Mobile Communications (GSM) in Europe, the authors argue that harmonization should be subtler and focus mostly on the new conditions for use of spectrum and particularly on the 'converging competition' which emerges from the fixed–mobile convergence of NGNs. Uncertainties caused by an ill-conceived regulatory framework which does not take into account the conditions for investment in NGMNs, or the conditions for competition and the conditions for innovation, will retard the NGMN deployment and it will result in a loss of the EU's competitiveness. Regulation has an important role to play in the intensity and speed of the NGMN deployment and can contribute significantly to the creation of value through the arrival of new applications and services. To do so, regulation must be swift and adaptive to the requirements the new technologies bring about.

In the final chapter, Chapter 15, Morten Falch, Anders Henten and Karsten Vandrup address the deployment of mobile data in Europe, East Asia and North America in order to identify reasons that may explain the difference in performance among these regions. The chapter focuses on the market conditions that prevail in each geographical market but it also addresses the role of policy in the deployment of data and mobile Internet. It is argued that to promote mobile data one needs to encompass a wide variety of policy areas since the development of mobile data depends on structural factors in the markets, particularly those pertaining to the supply side of the industry and the take-up factors like the general e-readiness of the potential users on the demand side.

The chapter notices and documents that the East Asian countries, Japan and Korea, are ahead in the global development of mobile data. While Europe took the lead in the 1990s with the second generation GSM system, the East Asian countries have been the front-runners with respect to mobile data, first on 2.5G platforms and later on 3G and 3.5G platforms. The US has been trailing somewhat behind in the 2G development but seems to catch up regarding mobile data. The question is what explanations there are for this development and what one can learn from it.

In order to examine this question, the chapter first discusses the reasons for the East Asian lead as compared to Europe and North America. The chapter includes explanations of a structural kind on the supply side as well as diffusion issues on the demand side. Theoretically, the chapter therefore takes its points of departure in theory on innovation systems and theory on diffusion. Secondly, the chapter examines empirically the development of mobile communications more generally, and mobile data

more specifically, in the East Asian countries, Europe and North America. Focus is on the terminal markets, network infrastructures, and services and content. The numbers show that the US is forging ahead regarding mobile data and that the European lead over the US in mobile communications is disappearing.

The prime reason put forward in the chapter for the North American catch-up is the position of the US in the information technology (IT) area, hardware as well as software. The US is positioned very strongly regarding Internet technologies and services, and the hypothesis is that the US can leverage this position onto the mobile field. The Internet innovation system and the mobile communications innovation system have to a large extent been separate. The East Asian countries have managed to merge them to a certain degree. However, the competences on the supply as well as the demand side in the US with respect to Internet technologies constitute a strong point of departure for developing mobile Internet in the US.

In sum, *Regulation and the Evolution of the Global Telecommunications Industry* is a collection of 15 chapters that bring a variety of theoretical perspectives and empirical evidence to the question of how regulation could be applied (even eliminated) to the deployment of BB technologies and NGMNs in an era of dramatic changes in the structure and performance of the global telecommunications industry. The material well illustrates the diversity of thoughts and research that characterize this important area of academic and business research. We hope that this volume will spur others on to research this challenging topic.