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The interplay between market factors and regulation in next-generation broadband: evidence from Europe

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The interplay between market factors and regulation in next-generation broadband: evidence from Europe

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Abstract

Although many factors affect next-generation access (NGA) deployment, regulatory frameworks have the power to guide future investments, further development and, consequently, the competitiveness of a next-generation broadband market. Understanding the link between markets and regulatory requirements, therefore, is essential. Using data collected from broadband stakeholders in three markets, this paper provides an empirical analysis of this relationship. The market conditions in The Netherlands, Sweden and the United Kingdom (UK) and their roles in influencing the regulatory decisions made by the respective national regulatory authorities (NRAs) are examined. Such analysis first shows that market conditions present different priorities for regulators and policymakers. While markets with weaker incentives for investment, such as the UK, are in need of regulatory and public policy intervention, The Netherlands and Sweden require less stringent measures. Despite this, evidence shows that some level of NGA regulation is presently required in all three markets, albeit to varying degrees and with different foci. The paper then highlights the interaction of the market factors, explaining that this interrelationship is more important for policymakers than the effects of a single factor. The findings of the paper are useful for regulators in addressing the challenges of next-generation broadband deployment.

Keywords: Next-generation access, Regulation, The Netherlands, Sweden, United Kingdom, Comparison

1 Introduction

The one billion Euro commitment to next-generation network development by the Irish incumbent Eircom is expected to enhance the broadband experience for up to one million Irish consumers. Conversely, on the supply side, the Internet Protocol (IP) Next-Generation Network (NGN) infrastructure deployed by Slovak Republic's Energotel offers greater network capacities and enables the operator to enter new markets and serve different customer segments. Through these and similar investments worldwide, telecommunications operators are transforming their networks, migrating towards rationalised networks in the core and higher capacity infrastructure in the access network. Based on IP, NGN promises the benefits of a simpler converged architecture, the delivery of more innovative services and lower costs. Next-Generation Access is beginning to emerge as a differentiating asset, enabling greater service opportunities for consumers compared to that available with existing infrastructure.

Despite being considered by the general telecommunications industry as the panacea of the industry, NGN and NGA are linked to a variety of challenges. A primary area of concern, evident within the wider next-generation telecommunications literature, is their regulatory implications. In general, regulators are struggling to find the balance that best encourages both investment and competition in next-generation infrastructure, with issues such as access, pricing and regulatory certainty to operators being at the forefront of the debate. In the quest for guidance, researchers such as Marcus and Elixmann (2008), Reichl and Ruhle (2008) and Kirsch and von Hirschhausen (2008) have looked into the regulatory strategies adopted by markets deploying NGN and NGA. Their discussions show that the regulatory requirements imposed by NGN are different to those imposed by NGA and regulatory development is driven by market actors and the particular market conditions.

In the context of varying regulatory frameworks, the UK, The Netherlands and Sweden present an interesting combination for comparison. While the three markets abide by European Commission (EC) laws, their regulatory foci for next-generation broadband are diverse. For example, OFCOM's aim is ensuring non-discriminatory access to BT's competitors to the incumbent's 21st Century Network (21CN) while OPTA continues to regulate access and, more specifically, access tariffs. Adopting a somewhat "in-between" tactic, PTS' efforts concentrate on ensuring open access to fibre networks.

Based on these discussions, the focus of this paper is to examine the relationship between market factors and regulation in next-generation broadband from an empirical perspective in these three European markets. Derived from data collected from key broadband stakeholders, the paper highlights the factors that currently influence regulation, describes the decisions put forth by the respective NRAs and examines the link between the two. By so doing, the paper complements the work of Cave and Hatta (2009), Bauer (2010) and others who discuss the relationship between markets, investment and regulation.

The paper is presented in four subsequent sections. Section 2 describes the methodology undertaken for the research, explaining the processes of data collection and analysis. Section 3 presents the case studies, detailing the market conditions and the corresponding regulatory approaches adopted for next-generation broadband as explained by the interviewees. In the fourth section, a comparison of the regulatory decisions in the three markets is presented while Section 5 summarises the research and the key results.

2 Methodology

The key inputs to this study are the views of over forty-five broadband stakeholders - incumbents, national regulatory authorities, alternative operators (both fixed and wireless) and researchers – in The Netherlands, Sweden and the UK. Through semi-structured interviews, the issues most important to the participants are identified and discussed. Interviewees and organisations were chosen based on existing publications on next-generation broadband, their role in the respective markets, recommendations and personal contacts. However, while interviews are the primary sources of data collection, the analysis is supported by existing literature, such as company and research reports, and follow-up questionnaires to the participants, thereby triangulating the findings and providing robust results.

A combination of qualitative techniques, including coding, concept and causal mapping, as described by Miles and Huberman (1994), is used to analyse the data collected. Emergent coding[1] and concept mapping[2] are used, for example, to aggregate participants' responses, highlight the main issues and examine the underlying relationships among the factors influencing regulation. This inductive approach to data analysis allows the dominant themes within the raw data to emerge and guide the output of this study, as Thomas (2003) explains, thereby accurately reflecting market conditions and the key issues relevant to this study.

3 Empirical evidence: regulatory implications of NGA for three European markets

Both theoretical and empirical literatures on broadband regulation show that regulatory policy enforcement is based on the status of the markets. While NGA is accompanied by many challenges and differences when compared to current-generation broadband, the significance of the relationship between market factors and regulation remains. The following discussions on The Netherlands, Sweden and the UK are used to illustrate this by describing the empirical impact of market factors on NGA regulation. The information presented herein are based on the analysis of interviewee data, as discussed in Section 2.

3.1 The Netherlands

Next-generation access deployment is a highlight of the Dutch market at the present time, particularly because market conditions are deemed generally favourable for investment in NGA infrastructure. Many factors encourage investment: competition, consumer behaviour, third parties such as local community and municipal leaders, and the geographical nature of the country. On the other hand, the existence of legacy copper networks and their financial implications for established operators deter investment to a small extent. In the regulatory domain, concerns about competition, the impact of the newly established joint venture, Reggefiber, and the potential of two infrastructures to sustain effective competition underpin the decisions made.

Of greatest significance in regulation is the presence of a competitive access infrastructure and service market. Dutch telecommunications was opened up to competition in the late 1980s by European Union (EU) regulations and was completely liberalised by July 1997 (van As, 1999). As of September 2009, the market has several fixed-line operators

[1] Codes were derived from both existing literature and from the participants' responses.
[2] Concept maps are diagrams that show organised knowledge and the relationships between them Novak and Cañas (2008).

including KPN, Tele2, UPC and Ziggo, three mobile operators - KPN Mobile, Vodafone and T-Mobile – and a growing number of MVNOs including Debitel Netherlands and Tele2 (Business Monitor International, 2010). Since 2007, the incumbent has an approximate 50% market share of fixed broadband penetration with the alternative operators collectively holding the remainder (Europa, 2010).

Infrastructure investments by these operators influence the competitiveness of the Dutch broadband market and, today, The Netherlands exhibits one of the highest penetrations of DSL and cable in Europe. DSL coverage is 100% by household while cable coverage is approximately 92% by population (OECD, 2010). In many areas, therefore, these are competing technologies. This level of infrastructure competition is one of the major drivers for NGA investment in The Netherlands, as DSL and cable operators upgrade their access networks in order to enhance their competitive potential. For example, in 2008, cable operators such as UPC and Ziggo began to invest in DOCSIS 3.0. Other fixed-line operators retaliate with fibre deployments, as fibre is considered to be the only sure-fire technology to compete with the DOCSIS 3.0 networks.

Infrastructure competition is enhanced by fibre roll-out from third parties. Eager to enhance the quality of life of their residents, communities and municipalities are key contributors to the hundreds of local, small-scale initiatives that currently exist (Point Topic, 2009). In the early stages of broadband development, the Dutch Government worked with the municipalities to deploy fibre access networks, a collaborative effort that consequently provoked private sector investment in fibre. Although the role of the Government is not as significant today, fibre roll-out has gained momentum with the municipalities and "local champions" in communities who are still eager to improve the lives of their residents and address the needs of its aging population.

Operators are also expanding from their traditional technological line of business into the fibre market. For example, DSL operator BBned offers fibre access and several cable operators - Ziggo, CAIW, KabelTV Bradant-Gelderland (KBG) and Kabel-Noord, for example – invest in fibre networks (Stratix, 2009). Most interestingly, in 2008 UPC launched DOCSIS 3.0 in Amsterdam and Almere, two cities where fibre-to-the-home deployments have been undertaken, and marketed their initiatives as "Fibre Power" as a sign of rivalry (Stratix, 2009).

Competition in service provision is also significant. Today, triple-play and quadruple-play offers are common, with almost 70% of all broadband connections providing bundled services (Europa, 2010). Cable operators, in particular show increasing tendencies towards bundled packages, incorporating broadcasting services as key products.

This competitive nature of the broadband market is the main concern of the Dutch regulator in the move to NGA. As Lie (2002) explains, the aim of regulation is to realise a competitive market, one that will ensure impartial offerings to consumers and continued investment by operators. Regulators, therefore, strive to achieve and maintain such a market condition. In the move to next-generation access, OPTA's obligation, therefore, is to ensure that the existing level of broadband competition in The Netherlands is maintained and, preferably, escalated, in both infrastructure and service domains. However, like many European regulators whose markets are deploying NGA, OPTA is challenged with striking a balance between encouraging investment in NGA while protecting and enhancing the competition that currently exists. In the case of The

Netherlands, however, the competitive intermodal environment increases the pressure on the regulator to ensure that market forces are preserved in this regard.

With this in mind, OPTA's view of next-generation access regulation is the promotion of "infrabased"[3] competition and, at this stage, believes that access to fibre networks is crucial in encouraging competition. Based on market analyses conducted in The Netherlands, there is specific concern about NGA access pricing (Boogert, 2009b). For example, investors of fibre are concerned about the rates of return they can attain on their investment while alternative operators and providers (the access seekers) are worried about high access tariffs.

The recent joint venture of KPN and Reggeborgh adds to these regulatory considerations for OPTA. The joint venture, Reggefiber, was created to merge the expertise of the two companies – the large customer base of KPN and the fibre network deployment skills of Reggeborgh. As a result of the strength of the joint venture from a competitive perspective, there are concerns about monopolisation of the market and a foreclosure scenario.

Consequently, OPTA's strategy is to ensure that Reggefiber provides unbundled fibre access to its competitors (Optical Distribution Frame access or ODF access) and, more significantly, to enforce long-term tariff regulation on the ODF access. At the heart of the policy is a price cap that is pre-determined by OPTA and re-evaluated every three years[4] to ensure that Reggefiber is receiving a realistic and reasonable rate of return on its investment without imposing excessive rates on its competitors[5]. The price cap is based on the actual business case and cost model (Bos, 2008). In this way, OPTA provides both long-term regulatory certainty to Reggefiber to encourage its investment and incentives to other operators to compete. As the investment associated with the deployment of FTTH networks is the most significant among the fibre models and requires regulatory certainty for a justifiable business case, the policy rules and corresponding regulation laid out by OPTA are focused on FTTH networks (OPTA, 2008).

Despite this solution, OPTA is concerned about the growth of competition in fibre networks and particularly, if fibre networks will present a natural monopoly. This is possible if the fibre network is serving large areas or remote areas or where there is no existing cable. In such areas, due to economies of scale, the deployment of a second infrastructure is not a worthwhile investment. If this situation presents itself, the existing degree of competition at the access infrastructure level will begin to deteriorate. A fear of monopolisation again emerges. In addition, as fibre and cable are competing technologies in many regions, the uncertainty of these two networks being enough for the sustenance of a competitive market continues to be a topic of discussion and research for Dutch policymakers.

The influences of the market factors in NGA regulation as described in the preceding paragraphs are shown in Figure 1. The diagram highlights that while a variety of factors are considered, the competitive nature of the market and the threat of monopolisation are

[3] "Infrabased" competition refers to competition via fibre unbundling (Boogert, 2009a).
[4] The Dutch Telecommunications Act states that the commission of the Independent Post and Telecommunications Authority must evaluate a decision after no longer than three years after it has taken effect (OPTA, 2008).
[5] Details of the price cap can be found in OPTA (2008).

central to the regulatory decisions made. A key feature, too, is that very specific market conditions exist in The Netherlands, such as the fear of high access tariffs, and result in targeted regulatory solutions.

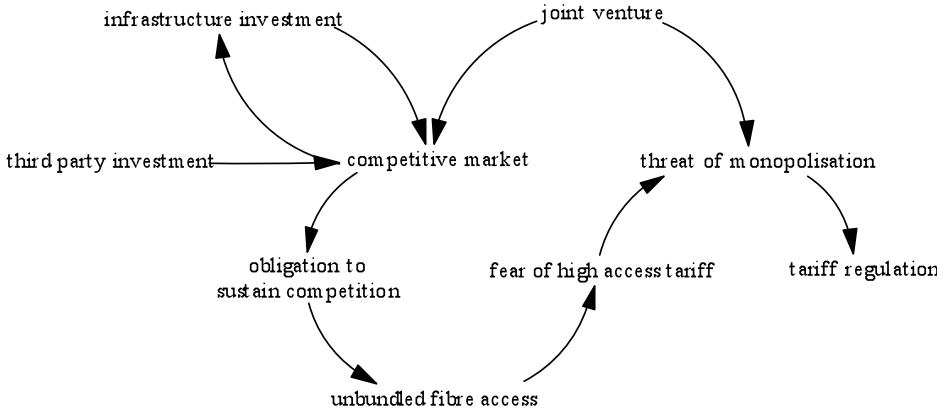

Figure 1: Market influences on NGA regulation in The Netherlands

3.2 Sweden

The Swedes' move to NGA is strongly influenced by Government support programs, third parties such as utility companies, the resulting level of broadband infrastructure and availability and consumers' use. While these factors positively influence NGA investment, uncertainties in future consumer behaviour discourage operators from deploying fibre networks on a large scale. A combination of both these positive and negative factors impact on the regulatory decisions made by the national regulator, PTS, as the discussions herein explain.

Historically, Swedish telecommunications has been shaped by a significant urban-rural divide, with a high percentage of rural population in the northern parts. At the end of 2009, however, broadband penetration reached 35% of the Swedish population, placing this country among the top ten in the world (Vanier, 2010). The broadband market is shared among TeliaSonera (38%), Telenor (19.7%), ComHem (12.3%), Tele2 (11.1%) and Hi3G (6.1%) (PTS, 2010). Broadband services are delivered over DSL, cable, wireless and fibre infrastructures, with 56.6%, 19.6%, 44.5% (mobile broadband) and 23.3% respectively of the total Internet broadband subscriptions at the end of 2009 (PTS, 2010). Furthermore, more than 98% of the population is covered by a high-speed network (Berkman, 2010).

The high penetration of existing infrastructure is attributed to the broadband support initiatives of the Swedish Government. The first of these, an employee program, offered tax reductions on computers bought by companies for their employees' personal use (Lindmark and Björstedt, 2006). In 2001, the Government instigated an IT infrastructure program which focused on providing broadband access to rural areas and other parts of the country where the market will not deliver. The digital availability achieved by these projects led to an increase in the use of and demand for Internet access by consumers and an advanced broadband market.

In adopting next-generation access, therefore, PTS' aim is to maintain this developed status of broadband and the level of competition without destroying the incentives for

investment by the significant market players. Of particular concern is the behaviour of the incumbent. With a 42% share of the broadband market (TeliaSonera, 2010) and 49% of the fibre coverage in 2009 (Berkman, 2010), TeliaSonera retains a size advantage in telecommunications infrastructure in Sweden. PTS views this as a significant regulatory issue and intends to maintain competition as close to the access infrastructure as possible.

However, since 2003 when the regulator ordered a reduction in local loop unbundling (LLU) access prices, LLU has played an important role in advancing competition (Broadband Wales Observatory, 2005). In the move to next-generation broadband, which eliminates the need for traditional telephone exchanges, a key issue for the regulator is to ensure that competition at this level is maintained and possibly increased. As a result, PTS has proposed regulations for both LLU and (dark) fibre access. In phasing out exchanges, for example, TeliaSonera is obligated to ensuring that competitors can continue to provide (fibre-based) services using the new fibre networks. Emerging from this, however, is the challenge of the incumbent and the alternative operators having different views on what can be sold and bought. Although TeliaSonera has restructured its business to show its impartial position in access provision and pre-empt functional separation requirements by OPTA, this remains a regulatory issue in Sweden.

However, fibre networks in Sweden is more widely deployed by a variety of third parties, primarily utility companies. One of the main responsibilities of utility companies, such as energy and electricity companies, is to install underground ducts for electricity and other cables. At the same time of these installations, several energy companies, such as C4Energi, took the initiative to install tubes for possible later fibre deployment. Today, these companies utilise their infrastructure for delivering next-generation broadband services. As the utility companies are usually owned by municipals, many of these initiatives are undertaken in collaboration. Consequently, several such independent local fibre networks exist in Sweden.

Although they have contributed to the development of NGA, the actions of the utility companies raise specific concerns of access and competition for PTS. The control of the last mile and the residential networks is an issue that PTS considers to be important in promoting competition and determining the extent to which end users will be able to choose between one or several access providers. The municipal fibre schemes are based on an open access model in which the municipalities own the networks, and sometimes the estate companies and land, with the authorisation to sell capacity to operators and other providers. As they sit on these important resources, the role of the municipalities in enabling wholesale competition is crucial and, therefore, their actions are important to the regulator. In some developments, estate owners, and not the municipalities, are the owners of the telecommunications infrastructure; the onus is then on the estate owners to ensure that competition is encouraged by allowing wholesale access.

In this regard, two situations are of particular interest to PTS and competition in general. The first is the case where operators refuse to provide capacity on its own fibre network to its competitors. The second is the attempt by operators to obtain exclusive rights from property owners on a residential network. In both situations, operators are striving for a monopoly and the actions of the liable owners are, therefore, crucial in developing competition. As a result, the agreements between operators and residential network owners are of concern to PTS. However, the regulation of the independent networks is not within the portfolio of the national regulator. Thus, PTS can only advise that different

measures must be enforced to allow wholesale access and access to third party providers so that a monopoly situation is not achieved.

The relationships identified from these discussions are shown in Figure 2. A variety of market forces can be seen to influence the regulatory strategy, with the core ones being the advanced state of the broadband market and the threat of monopolisation. A large incumbent and significant investments by third parties make open access obligations necessary for Swedish investors. The significance of these links are further discussed in Section 4.

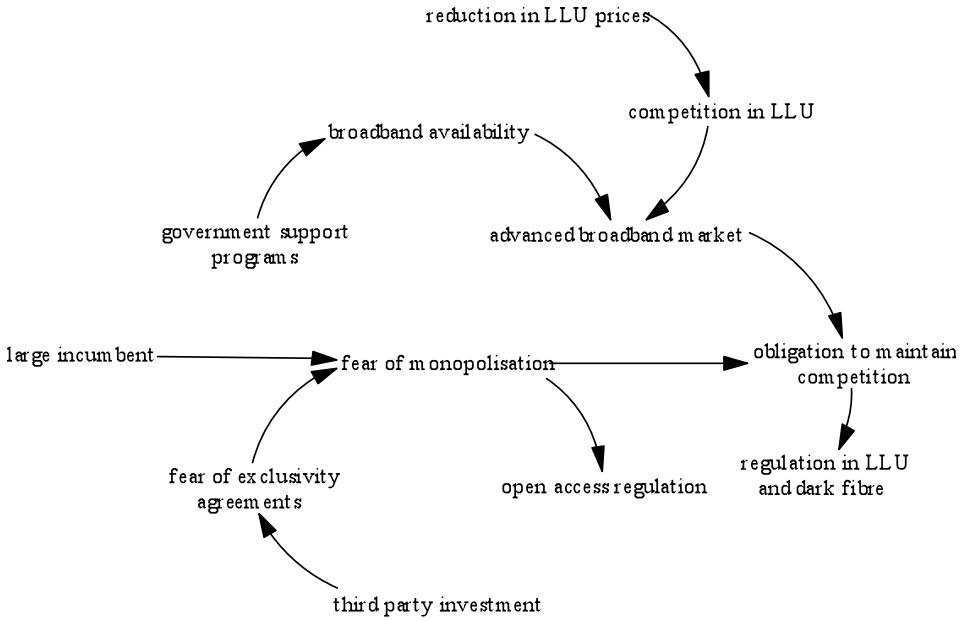

Figure 2: Market influences on NGA regulation in Sweden

3.3 UK

Next-generation broadband in the UK is largely focused on NGN rather than on NGA. In the NGA domain, many deterrents - consumers' satisfaction with current-generation broadband, digital gaps due to geographic challenges and the lack of regulatory certainty, for example - hinder NGA investments and, consequently, the development of NGA. NGN investments, on the other hand, are encouraged by the need for improved infrastructure as a result of the growth of IP-based services and the consequent decline of voice revenues. In addition, operators identify inefficiencies in their legacy networks in delivering new competitive services. The major fixed-line operators such as BT, who has an extensive but aging copper-based network, Cable and Wireless (C&W) and COLT have upgraded their core networks to NGN.

In response to BT's commitment to NGN deployment and as a result of BT's significant market power (SMP), OFCOM focuses regulation towards providing incentives for continued investment and for promoting competition based on the core network. OFCOM tries to ensure that alternative operators have access to BT's infrastructure and concentrates its efforts on interconnection and equivalence of access measures. For example, BT must provide access and interconnection at the local access network level, the core network level, the intelligence and application layers of its 21st. Century Network (21CN), and to systems and processes (OFCOM, 2005a). Apart from this, OFCOM adopts

a light-touch regulatory approach and is currently working on future proposals for NGN regulation.

At the broadband access level, the UK ranked sixth in total broadband subscribers in the world at the end of 2009, placing the market in third position among its Western European counterparts (Vanier, 2008; Vanier, 2010). At this same time, the UK had approximately 18.2 million operating broadband connections (OFCOM, 2010c). Although the UK's broadband position is among the highest in the world, the broadband distribution within the country is quite varied, adversely affecting NGA investment by operators. This non-uniform broadband availability is linked to two factors.

Firstly, in 2009, approximately 100% of UK households were connected to a DSL-enabled exchange[6] but, for geographical (distance from the exchange, for example) and technical reasons, not all of the connected households actually obtain broadband services (OFCOM, 2009b; OFCOM, 2009c). Secondly, although local loop unbundling (LLU) is widespread, LLU has high capital costs and, as a result, LLU providers tend to unbundle exchanges that serve a large customer base (OFCOM, 2009b). Since urban areas are more densely populated than rural areas, the former have higher broadband availability in the UK. At the end of 2008, more than 80% of urban UK was LLU-enabled while less than 50% of rural households received a similar service. The northern parts of Scotland are the most disadvantaged in both broadband availability (by speed) and LLU availability. Even within Scotland, the divide is evident, with LLU available in 70% of urban areas and in only 8% of rural regions (OFCOM, 2009b).

This issue of the non-uniform spread of broadband and the concern of an increasing digital divide in the move to next-generation access have informed OFCOM's decision of mandating passive and active access[7] for NGA regulation. The SMP held by BT in the wholesale access market further emphasises the need for passive and access wholesale regulation to ensure a competitive next-generation access market. For active access, OFCOM suggests a virtual unbundling strategy (Virtual Unbundled Local Access – VULA) whereby BT allows its competitors to access a dedicated virtual fibre link within BT's infrastructure. By so doing, competitors will have the opportunity to provide services to their customers under their own control and management. In turn, alternative operators and communications providers can deliver services to areas that are considered unprofitable by the larger operators. In order to provide an incentive to BT, OFCOM allows the incumbent to set its own wholesale price.

Despite these efforts, there is still uncertainty in the extent to which regulatory intervention will mitigate the impact of the digital divide in deploying NGA, causing the British Government to intervene with national policy recommendations. In a "Digital Britain" initiative, the Government proposes a Universal Service Broadband Commitment (USC) that ensures a 2 Mbps broadband service to all citizens by 2012. The Government intends to upgrade copper and wireless networks with fibre to the street and DSL, with satellite where necessary, to ensure that the target speed can be delivered. Prior to this

[6] As DSL is the most widely penetrated broadband technology in the UK, OFCOM used the availability of DSL to measure the overall broadband availability in the UK (OFCOM, 2009a).

[7] Passive access is providing access to competitors to a network owner's physical infrastructure, over which the alternative operator utilises his own electronics to deliver services. Active access refers to access by alternative operators to the network owner's physical infrastructure and electronic equipment to deliver services (Onwurah, 2009).

proposal, BT and Kingston were held under a Universal Service Obligation (USO) imposed by the European Commission through OFCOM (OFCOM, 2005b). The USO mandated the provision of only functional Internet access (FIA) to households upon request at speeds of at least 28.8 kbps (OFCOM, 2005b). Even with this obligation, Internet access is limited in certain parts of the UK. Scotland, for example, exhibits an overall Internet access penetration of 62% by population, compared to 80% in London (Office for National Statistics, 2009).

The second Digital Britain objective is the "Final Third" Project, which aims to deliver next-generation broadband to the last third of the population that will not be served by market-led competition. The deployments will be funded through a Next-Generation Broadband Fund, established by imposing a 50p levy on all fixed line connections in the UK. Since its announcement, the Fund has surfaced many debates and was subsequently withdrawn in April 2010 when the Labour Party advocating the Fund was voted out of authority (BBC, 2010). Consequently, the licence fee reserved for digital switchover in the UK is targeted for NGA roll-out[8].

The influences in the UK as described in this section are illustrated in Figure 3. The figure shows a clear distinction between NGN and NGA investment in the UK, and draws attention to the fact that the market conditions impose greater regulatory requirements on the development of next-generation access than on the development of next-generation core networks. Of particular interest is the need for national broadband policies in addressing the concerns of a digital divide with NGA migration.

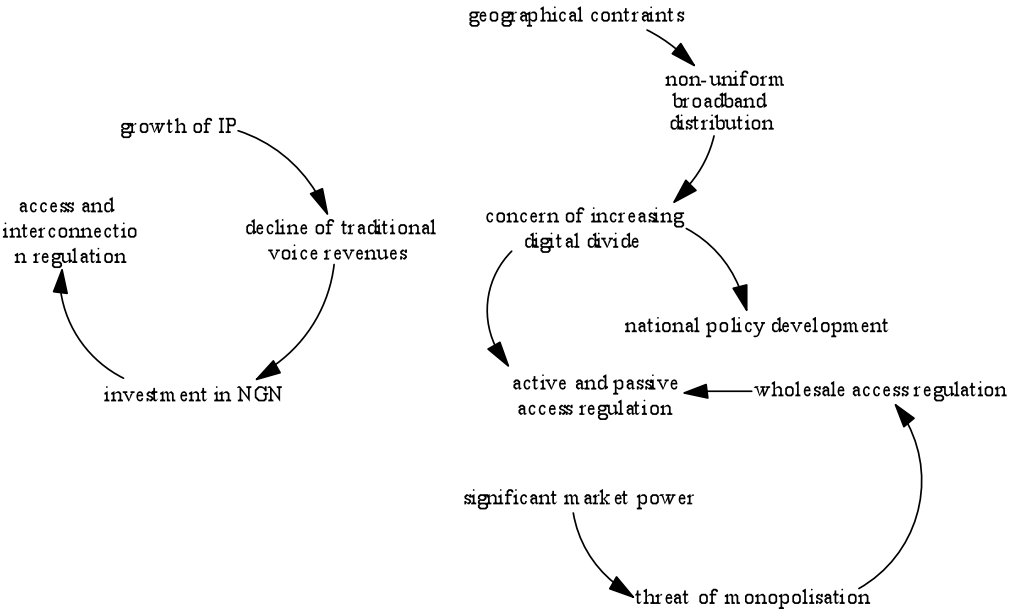

Figure 3: Market influences on NGA regulation in the UK

[8] There are now concerns that the leftovers of the digital switchover project will not be sufficient for the planned NGA deployment.

4 Discussion

Table 1 captures the regulatory scenarios in the British, Dutch and Swedish markets as discussed in Section 3. On a general level, the table shows that the three markets are at different stages of NGA investment as a result of different underlying market conditions. Consequently, the regulatory considerations and strategies employed are diverse. An understanding of this interplay between markets, investment and regulation is important in advancing NGA.

	The Netherlands	Sweden	United Kingdom
Market conditions	Aggressive infrastructure and service competition Joint venture of KPN and Reggeborgh	Large incumbent Investments in fibre networks by a variety of third parties Advanced and competitive broadband market	Aged core legacy networks and core network competition Existing digital divide Late regulatory certainty to operators Lack of consumer demand
Next-generation broadband status	Significant NGA investment	Fair NGA investment Many municipal/local fibre networks	Significant NGN investment Little NGA investment, but growing
Regulatory responses	ODF access Access price cap	Access to dark fibre Access to copper Open access model for municipalities	Passive access Active access – virtual unbundling National policy intervention

Table 1: Regulatory overview of three European markets

In The Netherlands, for example, there is significant investment in NGA as a result of competitive access infrastructure and service offerings. As there are incentives for NGA investment from consumer demand (for example) and signs of an expanding NGA market, the focus for OPTA is on ensuring that the level of competition that exists in current-generation broadband is maintained in next-generation access, rather than on encouraging initial NGA investment. One of the key priorities, therefore, is ensuring that the joint venture, who has the potential to dominate the market and create a foreclosure situation, does not deter investments by alternative operators and third (fibre) parties. Thus, regulating the terms and conditions under which investors and network operators provide access to their networks is important. As access tariffs have been identified as a major concern for potential investors, OPTA has chosen to pay particular attention to regulating these conditions.

In contrast, in both Sweden and the UK where NGA investments are less, regulatory efforts are focused on providing initial incentives for investment. To some extent, this challenge is smaller for Sweden than for the UK, as deployment seems more promising in the former due to, largely, investment by municipal and utility companies. However, this situation raises another issue in the regulatory discussion for PTS, namely network access. With the wide range of investors, open access to this variety of networks is necessary to encourage service provision by alternative parties and the further evolution of a

competitive NGA market. Furthermore, some incentives for investment by the larger operators are required.

In the UK, the provision of incentives for initial investment is a must as, unlike The Netherlands and Sweden, there has been little NGA investment to date. As the primary deterrent under regulatory control is the prevailing "broadband divide" and, consequently, the inability for operators to justify the business case for investment in many areas, OFCOM must provide some means of facilitating, physically and commercially, the deployment of NGA. As a result, the attention of the British regulator is focused on ensuring access to both passive (ducts, for example) and active (for example, a dedicated virtual fibre link) network elements.

The lack of investments and, more specifically, the digital divide has moved the regulatory debate in the UK to a wider national level. Government intervention is deemed necessary by many researchers, politicians and industry members to advance NGA roll-out, to address the non-uniform digital availability and to ensure that the move to NGA does not widen the existing digital gap. Both the Dutch and Swedish governments have provided similar aid in the development of current-generation broadband, and accordingly in next-generation access deployment, in their respective markets. Furthermore, although the UK and Sweden are similar from a geographical and digital divide perspective, the availability of alternative infrastructure roll-out plans in Sweden through (ducts of) state-owned utility companies prevent the need for an intensive national NGA policy in this market. While an attempt was made to adopt a similar strategy in the UK by using waste-water (sewerage) infrastructure to house fibre cables, the pilot was abolished because of technical and business problems, as Drury (2010) explains: 'The technology methodology didn't work for us, nor did the reward for placing the cables in the sewers.' The use of other infrastructure in Sweden, however, as previously explained, means that regulation is concentrated on open access provision while in the UK regulation is targeted at the telecommunications infrastructure duct and pole sharing by the incumbent.

In a more general sense, the comparison highlights that the interaction of market factors is important in influencing the regulatory strategies adopted by NRAs. Figure 4 shows an aggregated map of the relationships, derived from Figures 1, 2 and 3. The key feature of the diagram is that although several core influences can be identified - a competitive market, the threat of monopolisation and the obligation to maintain competition – the fear of creating a monopoly is significant in NGA deployment. Furthermore, although this seems to be a common factor across all three markets, the different "arms" shown in the diagram originating from this concept illustrate that different regulatory strategies are adopted by the three regulators. This emphasises the significance of the relationships among market factors in creating unique investment and regulatory environments in NGA and in determining the priorities for regulators.

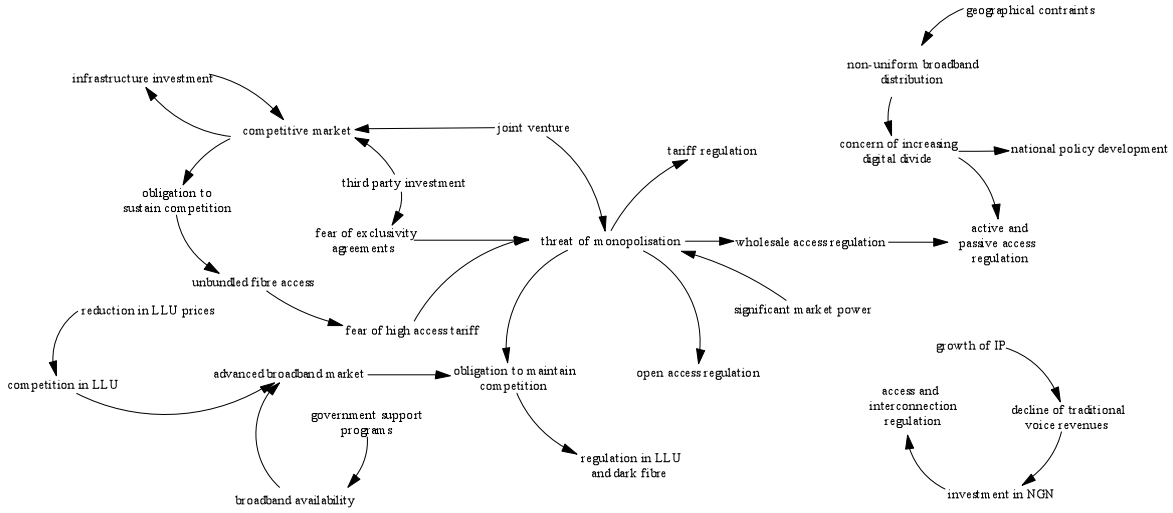

Figure 4: Overview of the interactions between market factors and regulation

Although the situations, regulatory strategies and focus in the three markets are varied, this discussion reveals that regulation of NGA in all three markets is inevitable at the present time. Uncertainties in how competition will develop as a result of the high capital costs of NGA deployment make regulatory intervention necessary even in the competitive Dutch market. The Swedish experience shows that, in a market in which a diverse range of players is active in infrastructure deployment, open access is important while the UK is exemplary in illustrating that state intervention is essential in markets where there are severe geographical constraints and limited market incentives for investment. Furthermore, in all three markets, evidence shows that the regulatory decisions are influenced by a combination of market factors and not single-handedly by any given condition.

5 Conclusion

The move to next-generation broadband is compelling regulators and policymakers to review their existing regulatory regimes to adapt to changing market conditions and requirements accompanying NGA roll-out. The evidence collected from broadband players in The Netherlands, Sweden and the UK show that, as investment scenarios and NGA status are different in the three markets, the regulatory priorities for NGA are varied. For example, early movers such as The Netherlands are encouraged to invest because of infrastructure competition and consumer demand, and exhibit an NGA market that shows likely continued market-led investments. However, the KPN-Reggeborgh joint venture has raised concerns about a potential monopoly with particular emphasis on access pricing. In order to sustain competition, OPTA enforces access tariff regulation.

Incentives for investment in Sweden are not as strong as those in The Netherlands and have encouraged investment by third parties and smaller operators rather than the larger incumbents and others. As a result of the variety of small, localised fibre projects and investments by utility companies and municipals, PTS believes that an open access obligation is necessary. Thus, like The Netherlands, the focus of NGA regulation is not in encouraging initial investments but in regulating the investments that have been made to ensure future investment and sustained competition.

On the other hand, regulation in the British market revolves around providing incentives for initial investment as the market is disadvantaged in incentives for a justifiable business case, geographical constraints and, consequently, little NGA investment. OFCOM attempts to advance the deployment of NGA by making it physically and economically easier to install optical fibre networks through the enforcement of both passive and active access provision remedies. However, because of the large digital gap across the country, Government support is necessary to promote NGA investment. Thus, in addition to the regulatory solutions, several national next-generation broadband policies are being considered.

The analysis shows that, while the markets are different in their regulatory strategies as a result of different market conditions and NGA status, there is some overlap in the concern of moving backwards from a competitive broadband market to one that is monopolised in next-generation access infrastructure. A combined view of the relationships in the three markets, however, reveals that other market influences are inevitably considered in conjunction with the threat of monopolisation to inform regulatory decisions.

Being among the most advanced markets in NGN and NGA, the British, Dutch and Swedish approaches to regulation are likely to influence others around the globe in their own development and exploitation of next-generation networks. As a result, the discussions and findings highlighted in this paper provide not only an understanding of the factors the affect the development of regulatory regimes, but a practical guide for policymakers in managing the deployment of NGN and NGA.

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