Achieving Universal Access to Broadband

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The paper discusses appropriate policy measures for achieving universal access to broadband services in Europe. Access can be delivered by means of many different technology solutions described in the paper. This means a greater degree of competition and affects the kind of policy measures to be applied. The paper concludes that other policy measure than the classical universal service obligation are in play, and discusses various policy measures taking the Lisbon process as a point of departure. Available policy measures listed in the paper include, universal service obligation, harmonization, demand stimulation, public support for extending the infrastructure, public private partnerships (PPP), and others.
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1 Introduction

The paper examines investment dimensions of broadband in a universal service perspective in a European context. The question is how new network infrastructures for getting access to communication, information and entertainment services in the present and future information society will be funded. In this vein, alternative funding mechanisms including private-public partnerships are discussed.

Since the liberalization of telecom operations, universal service provisions have been included the European regulatory framework for communication networks and services. This was to prevent concern that a liberalized market could result in under-served markets segments, if such segments were not sufficiently profitable. Obligations regarding minimum service levels were, therefore, put on (incumbent) operators. Universal service provisions have traditionally been related to telephony, the voice service and the access network necessary for providing telephony services. However, it has all along been foreseen that universal service provisions also could be related to newer technology solutions. Mobile and broadband have been cases in point. Following the present EU regulatory framework from 2002 [5], the scope of universal service should be examined every third year, the second review of the scope of universal service was published in 2008 [9]. It is here concluded that broadband not yet fulfill the conditions for qualifying as a universal service. Furthermore the paper raises the question of "whether a universal service at EU level is an appropriate tool to advance broadband development".

This may refer to the policy tools included in the Lisbon process, where the development of a European information society is one the primary objectives, and where broadband access plays a crucial role. The topics discussed here deal with a wide range of policy measures available for establishing broadband access infrastructures. These include regulatory measures such as the Universal Service Directive as well as facilitation and direct support.

The paper looks first at the range of policy measures available for promoting broadband access considered in the Lisbon process. This is followed by an overview of existing and upcoming access network technologies. Before concluding, there is a section on alternative funding mechanisms including a sub-section on the potentials of Private Public Partnerships (PPP) in providing funding for broadband access infrastructures.

2 Available Policy Measures

The policy measures range from awareness raising and regulatory provisions to economic support of different kinds to the demand or supply side. More specifically, it can be the building of public research & education networks, unbundling of broadband access, tax incentives for broadband take-up, and financial support for setting up broadband access infrastructures. Mostly, however, this is not conceptualized as universal service policies. The universal service concept is still reserved for the traditional imposition of obligations on operators. Nevertheless, we are dealing with different kinds of universal services policies – or at policy initiatives to broaden access to broadband.

An increasing number of publications have been issued discussing the many diverse factors - including policy factors - affecting broadband development. The point of departure is the observation that the penetration of broadband varies to a great extent even between countries with similar GDP per capita. Examples of such publications are 'Global broadband battles – Why the US and Europe lag while Asia leads', edited by Martin Fransman [12] 2006) and reports from the EU project BREAD on broadband development for all, for instance, "Broadband in Europe for all: A multidisciplinary approach" by Peter van Daele et al. [4].

In the following, six different kinds of policy measures are listed – with the 'lightest' forms of intervention first and the 'strongest' at the end:

- Strengthening and harmonization of the internal uses of ICT (information and communication technology) networks and services in public institutions.
- Developing public communication networks and services relating to citizens and business enterprises – with influences on the take-up and forms of communication used in the society at large.
- Facilitation of the development of communication networks and services. This may include increasing transparency in the markets by way of public information on qualities and prices of communication networks and services, and it may include the setting up by public agencies of forums for discussions on, e.g., interconnection and frequency issues among the competing operators and the public authorities.
- Regulation proper, setting the 'rules of the game' in the markets, and the enforcement of such rules.
- Support for the demand for communication networks and services, which may be based on either the direct demand from public institutions or support for the demand from private citizens and business enterprises. Included in this category can also be mentioned education initiatives enhancing the competences of people in using ICT networks and services.
- Support for the supply of ICT networks and services, which may involve public funds going into network and service deployment, but which may also be of a more indirect character involving public research and development and public education of people whose labor power will be used in ICT business enterprises.

The two first mentioned points are related to e-government initiatives. They concern the use of ICTs internally in public organizations and public sector organizations' communications with citizens and companies. The activities of public administrations in these fields will indirectly lead to the promotion of the use of ICTs on a broader scale in society.

The two following points are connected to the ICT sectors themselves – facilitating their modes of functioning and setting and enforcing the regulatory frameworks. Facilitation as well as regulation can have decisive influences on the industrial development. The whole liberalization process in telecommunications has definitely had a great influence on the development of this sector.

The two last points, support for demand and supply, are often connected with the term industrial policy. Public support for the demand side can be important for industrial development and is seen as more acceptable than support for the supply side. State initiatives in the field can be of different kinds. State procurement in itself is important, as state organizations often are large customer, and as goods and services based on new technologies can be helped to grow in the market by means of initial fostering. But the state can also help specific sectors by promoting private demand, either by creating a fertile environment for industries, which are large users of specific goods or services, or by helping residential demand.

Support for the supply side includes direct economic support, which has often been seen as the essence of traditional industrial policies. This kind of industrial policy measure has lost importance in the EU and elsewhere during the past couple of decades. It is, generally, neither favored by the individual member states nor the EU as such, as it is seen as distorting to the competitive environment. However, when dealing with less profitable, e.g. rural, areas, there is support for public funding at the EU level as well as the national level. In a Communication from the European Commission, public funding including funding from the EU Structural Funds and the Rural Development Fund is explained and recommended as one of the 'available instruments' [3].

There are, however, other kinds of policies supporting the supply side of industries which are not only generally accepted but also considered as strongly recommendable, as they are more certain to contribute to technology developments. This applies to R&D initiatives as well as educational initiatives, which in both cases can be of a general nature, not discriminating between different industrial areas, but can also favor specific sectors of the economy, which most often has been the case with publicly funded R&D. It also applies to initiatives promoting industrial development by way of supporting the development of innovative milieus, for instance in the form of science parks, intelligent cities etc.

3 Universal Service in a Next Generation Network Context

An important question regarding new network developments and the scope of universal services is concerned with the increasing importance of Internet Protocol (IP) and Next Generation Networks (NGN). Where the different services formerly would be offered on dedicated networks, NGN and the use of IP make it possible to deliver many different services on just one network or one service on different networks. Telephony services can be delivered on different networks and the requirements for having fixed telephony services is access itself, i.e. broadband access which makes it possible to use IP-based services. This radically changes the present scope of universal services from focusing on a set of services and their underlying dedicated networks towards focusing on the access issue [6]. This brings the discussion on the scope of universal service back to the question of broadband access.

Incumbent operators in a number of European countries will in the coming 5-10 years be closing down their PTSN, and telephony will either be mobile or IP-based. If, in this situation, fixed access to telephony services is to be secured for all citizens, there will have to be universal service on access to broadband connections.

The NGN concept entails that there is a separation between the infrastructure and the services delivered via the infrastructure. This split is part of the technological concept, but may also be promoted via a regulatory separation between infrastructure and service provision. This means that technologically as well as with respect to regulation there is a trend towards a separation of infrastructure provision and service provision. The present conceptualization and scope of universal service does not seem to fit this development well. The question is whether this will lead to an inclusion of broadband access into the universal service scope or whether it will lead to a reliance on the many other policy measures which can be used to enhance broadband access.

The separation between infrastructure and services facilitates development of alternative infrastructures based on competing technologies. Each of these different technology solutions implies different market and techno-economic characteristics, and the effectiveness various policy measures depend therefore on which technology solutions that will dominate the future broadband infrastructures. The relevant network technologies are discussed in the following section.

4 Existing and Upcoming Network Broadband Infrastructure Technologies

The penetration of fixed broadband services in the EU was by July 2008 21.7 per 100 inhabitants. There is, however, a substantial variation among countries. The penetration ranges from 37.4% in Denmark to 9.5% in Bulgaria [8]. There is, furthermore, as substantial gap between penetration in rural and urban areas. According to a study by IDATE, the penetration in rural areas is just over 50% of that in urban areas [17]. One reason for this is better coverage and lower prices in urban areas. Increasing use of alternative networks will help increase rural coverage and closing the gap between rural and urban areas.

Access to next generation networks can be offered by use of a wide range of different network access technologies each having their own specific comparative advantages with respect to technical capabilities and economic costs. This variety in technologies is closely related to the variety in network providers and in funding mechanisms. While telecommunication operators tend to prefer technologies reusing existing network infrastructures, other operators pay attention to scalability and demand for long term investments. The techno-economic and market characteristics of the various infrastructures are summarized in table 1.

4.1 Upgrade of existing based telecom network (xDSL)

The major advantage of xDSL is that it is offered by use of the existing copper based access network, which is widely available. xDSL is the most widespread access technology for broadband access as 60% of all broadband connections use xDSL (mid 2008) [18]. Presently, 90% of the population within the EU lives in areas covered by xDSL services. In rural areas, the coverage is around 70% [7]. In areas with xDSL coverage, use of existing infrastructure facilities is still very competitive in providing most types of services. However, in areas not covered by copper-based networks, use of other network technologies is likely to offer a cost efficient alternative.

Table 1. Techno-economic characteristics of infrastructures

	xDSL	**Cable modem**	**Fibre**	**Mobile**	**Wireless**	**Satellite**
Availability	High	Varies (mainly in cities)	Low	High	Medium/low	High
Ownership	Incumbent Telco	Telcos/cable operators/ municipalities	Telcos/power companies/ municipalities	Telcos	Often SMEs	Satellite operators
Capacity	Medium/low	Medium	High	Low	Medium/high	High
Costs drivers	Distance/connections	Distance/connections	Distance/connections	Area/capacity	Area/capacity	Capacity
Lifetime	Very long	Long	Long	Short	Short	Medium
Fixed/variable costs	High fixed costs	High fixed costs	High fixed costs	Medium fixed costs	Medium/low fixed costs	High fixed costs
Economies of density	High	High	High	Low/medium	Low/medium	Low

4.2 Cable modem

Cable modem offers an attractive alternative to xDSL in areas covered by cable TV. 35% of the EU population lives in areas where it is possible to use cable modem. However, in rural areas only 10% has this opportunity [7]. The availability of cable TV varies from country to country. In some countries, like the Netherlands and Belgium, this service is available to 80-90% of the households. In other countries, this service is only available in major housing complexes, while other countries are virtually uncovered.

In particular in high density areas, cable networks can offer a cost efficient alternative to xDSL services. In mid 2008, cable provided 29% of all broadband access connections [18]. The coverage of cable networks is much lower than that of telecom networks. Therefore, the market share is higher than for xDSL in those areas where this technology is available.

4.3 Optical fiber networks

Optical fiber networks have replaced copper cables in large parts of the core network, but up to now optical fibers are not widely available in the local loop. Optical fibers are currently not more expensive than copper cables, but as with copper cables, laying the fibers underground constitutes a substantial part of the costs. Therefore, replacement of copper based cables with fibers is a costly affair. In addition to this, the end equipment converting optical signal to electrical signals and vice versa is also expensive. Within EU only 1% of all broadband connections are fibers (July 2008). However, in a few countries the penetration is much higher (Japan 45%, Korea 39%, Sweden 19% [18].

Deployment costs including components, civil works and installation have in Europe decreased from 1250-1500€ per connection in 2001 to 600-800€ in 2006 [14]. The major cost component is civil works related to deployment of fibers. These costs can be reduced substantially if duct capacity is available beforehand.

4.4 Mobile and wireless networks

Wireless networks include a wide range of technologies in the access as well as the core network. Wireless cellular networks supporting mobile communication are the most widespread. The capacity of 2G networks are too limited to provide an alternative to the fixed networks as an infrastructure for provision of most types of data services. 3G networks are able to provide some data services but the capacity is still lower than what can be offered by use of xDSL, cable or optical fibers. Establishment of 3G networks is also more costly than establishment of 2G networks, in particular in low density areas, as maximum cell size is much smaller than for 2G services. In high density areas, however, the costs per bit may in some cases even be lower than in 2G networks.

The cost factors depend rather weakly on the basic type of radio technology employed [13]. The costs of establishing a new network are considerable lower than for a fixed network, as the costly last mile can be completely bypassed. In particular 2G networks have proved to be a cost effective viable alternative for provision of telephony services. Compared to a fixed network, the investment costs constitute a much lower share of the overall costs. Still a major share of the investments costs are in the access network as the site build out constitutes 30-50% of the investments costs.

Implementation of 4G networks using either WiMAX or LTE will enable mobile broadband services with capacities comparable to what is offered today by use of xDSL [22].

So far fixed wireless networks play a limited role for the total penetration. Only in the Czech Republic is access via other wireless networks widespread: one third of all broadband connections are provided by a wireless connection. In Ireland and Slovakia, 15-17% is provided in this way. In all other EU countries, the figures are below 3% [18].

4.5 Satellite

Satellite networks are particularly cost effective for broadcasting and for transmission over long distances in remote areas. A major advantage is that use of satellite enables a complete bypass of regional and even national network facilities. The major cost component is the satellite itself. The major cost driver is, therefore, traffic volume, while distance does not affect costs. Satellite is cost-effective in low demand areas without a reliable communication infrastructure. Such areas are mainly found in developing countries. In Europe use of satellite for two way communication is less relevant.

5 Alternative Funding Mechanisms

The traditional way of funding universal service in disadvantaged areas has been through some kind of cross subsidization funded by service provision in other areas. Funding has often been channeled through a universal service fund supporting service provision offered by rural operators. Sometimes universal service is secured by appointing one or more operators (usually incumbent operators), which are requested to offer a number of basic services on certain specified conditions.

As discussed in section two, it has been considered to include broadband services in the definition of universal services. There are, however, other ways of funding universal broadband access. As noted in section five, the emergence of new access technologies, which can be developed independently of the service layer, facilitates a development, where parts of the infrastructure is provided by other actors than the traditional telecom operators.

Alternative funding mechanisms include, therefore, other types of funding than those coming from traditional telecommunication operators or a universal service fund financed by contributions from telecommunication operators. Alternative funding mechanisms include:

1) Public funding programs and investments
2) Investments by private companies
3) Funding through non-profit organizations
4) Public Private Partnerships (PPP)

Communication networks are of crucial importance for economic development. There is, consequently, a clear rationale for promoting access to Next Generation Networks through various public programs. Public programs involve stimulation of demand and supply as well as regulatory measures ensuring a more well-functioning and competitive market. Of these various instruments, stimulation of the supply side through public funding of infrastructure investments is clearly the most controversial.

Nevertheless, public funding is used in most parts of the world. In United States, the Government, among others, has introduced a 'Federal Rural Broadband Access Loan and Loan Guaranty Program', and several regional programs involving public funding exist [11].

Australia spends more than 4 billion AUD on regional telecommunications funding. In April 2007, a broadband guarantee offering access to affordable metro-comparable broadband services in remaining broadband black spots [1] was established.

Public finding is also used within the EU. The European Commission includes both state aid and EU funding provided by structural funds and the Rural Development Fund as available instruments for closing the broadband gap within regions in Europe [3].

The EU Commission is highly concerned with whether public funding will distort competition. The Commission has, therefore, been reluctant to allow direct funding of infrastructure development. Until recently this was mainly done in relation to the establishment of high speed research and education networks connecting universities and other research institutions. Use of funds allocated for regional and rural development for funding of network infrastructure was not included in eEurope 2000-2002 and the eEurope

2005 plans, but was included in the i2010 plan.
Funding of research and education networks helps universal access to NGN in two ways. First, it stimulates supply and demand in general through the promotion of use for research and education purposes. Second, research and education networks include public institutions in rural areas such as public school and libraries. This improves public access to NGN facilities for citizens or small businesses without their own connection.
In order to avoid distortion of competition, the Commission reviews national project for state funding of broadband infrastructure. Infrastructure support must be given to bridge the digital divide. Support should, therefore, be limited to areas where it is not commercially viable for private sector operators to establish adequate facilities. The Commission distinguishes in this context between white, grey and black areas [19]. White areas are sparsely populated rural zones, where no broadband access except via satellite or leased lines is available. In such areas, state aid is in general allowed. Grey areas are areas, where broadband is already provided. Here, permission for state aid demands a more detailed assessment. Finally, black areas are those, where at least two competing infrastructures exist, and where there will be a high risk for market distortion if state funding is allowed. In such areas state aid is generally not allowed.
An example of a white area is in rural Greece. In mountainous and sparsely populated areas in Greece, broadband access at an affordable rate will be difficult to provide without substantial external funding. State aid is, therefore, central in the Greek broadband strategy. Another example is laying of an optical fiber network and establishment of Rural Internet Access Points in Lithuania.
An example of a grey area project, which has been approved, is the establishment of an optical fiber infrastructure in urban areas in Ireland. The infrastructure will be used for providing wholesale communication services to all potential retail telecom areas. The network infrastructure will remain in public ownership and will, subsequently, not distort competition.
The emergence of NGN networks has made it viable for new entrants to establish their own communication infrastructures providing Internet access and other communication services directly to end customers. In particular two types of NGN networks are can be expected to play a role in the future communication infrastructure:

1) Optical fiber networks established by operators of other types of network infrastructures, e.g. electricity companies.
2) Wireless networks

The entrance of public utility companies on the telecommunication market is not a new phenomenon. Railway companies, for instance, played an important role in creating competition in the market for distance communication facilities in the early days of liberalization [10].
The entrance of public utility companies as providers of local access came, however, first at a later stage. The opportunity to combine investments in optical fiber networks with the laying of electricity cables or to use existing duct facilities became more profitable with the emergence of triple play. In Denmark, where the number of fiber access in private homes (FTTH) has doubled within the 12 months [15], it is expected that 60% of all homes are covered within 5 years. Electricity companies are the major actors. One example is NESA/DONG, which provides electricity to around 500,000 homes in the capital region. NESA/DONG acts as a pure infrastructure provider providing the basic infrastructure for a number of service providers offering Internet access, TV broadcast, video on demand or IP-telephony [21]. Similar business models are applied by other electricity companies, e.g. Reykjavik Energy in Iceland and Mäler Energy in Sweden [22].
Use of wireless technologies for broadband access is less widespread and growth has been disappointing the last couple of years. One problem is that although there are clear cost advantages in network facilities, spectrum costs can be a problem. Although the potential for using wireless solutions is highest in rural areas, private companies providing wireless solutions, such as the small Danish company Danske Telecom, have so far focused on urban areas, where customers are more concentrated.
Decreasing investment costs has in combination with the lack of interest of established telecommunication operators in providing competitive services led to the establishment of a number of community networks. Such networks are established by local grass-root organizations in a local housing area or in a rural area, where demand aggregation has made it possible to provide an attractive alternative to the established operators. DjurslandS.net in Denmark is such an organization. It is based in an area, where 25% of the population at that point in time lived outside the reach of xDSL services. Therefore a wireless

network was established on the initiative of the local community. DjurslandS.net managed in 2002 to obtain a grant from the EU and became the largest non-commercial wireless network in Europe [21].

5.1 PPP

Public-private partnerships can be seen as one of the ways of attracting funding for the extension of communications infrastructures. PPP can be defined as ‘a cooperative venture between the public and private sectors, built on the expertise of each partner, that best meets clearly defined public needs through the appropriate allocation of resources, risks and awards’ (CCPPP).

Public-private partnership (PPP) involves the co-operation of two parties, the public sector and the private sector, and either refers to private sector entities carrying out assignments on behalf of public sector entities or to fulfill public policy goals or public sector activities helping private sector entities. Lately, discussions on PPP in the communications infrastructure areas have often dealt with the public sector helping in building communications infrastructures where the returns on investment are considered to be too low for private operators. Traditionally, however, the PPP term has been used to denote that private sector entities, at different levels and scales, take care of activities traditionally performed by public sector entities. Where many discussions on PPP, therefore, presently focus on market failures and the need for the public sector to rectify such failures, PPP can just as well be concerned with public policy failures.

In our context, however, there is focus on the contributions that public sector investments can make to the extension of communications infrastructures in areas which are considered to be too little profitable for private investors. The reason is that while telecommunications has increasingly become privatized with the telecom reform since the late 1980s, there are still strong public interests in the extension of communications infrastructures as these infrastructures constitute a communication backbone in societies. To the extent that private capital does not invest sufficiently to cover these communication needs, public funding may be necessary to ‘fill the gap’.

This may apply in geographically peripheral or poor areas, i.e. in areas where private operators may not be able make a profitable business. It can also be that it is politically decided to build out infrastructures and service provisions at a faster pace than is considered commercially profitable. This actually happens in a number of economically developed countries in the deployment of broadband infrastructures. With the great emphasis that many economically developed countries put on broadband development, initiatives are taken to put public funding into the building up of broadband infrastructures. These infrastructures may eventually be taken over by private operators when they are able to run a profitable business. These cases, therefore, illustrate the opposite development of traditional PPP arrangements, where private businesses build infrastructures that later on are taken over by public sector entities.

Furthermore, instead of limiting the partnership arrangements solely to the public sector and private companies, there should be room for other individual and collective actors, including civil society/non-governmental organizations. Consequently, it would be a multi-stakeholder arrangement, also called Multi-Stakeholder Partnership (MSP), which would not only centre on the private/public dichotomy. This extension of the sphere of cooperation would be in line with transcending the simplistic distinction between market failures and policy failures and to take a more holistic view on the system failures and the possible remedies including MSG arrangements.

Relatively little has been written using the PPP perspective on finding alternative funding mechanisms for extension the infrastructure to areas which are considered of low profitability. The reason is the abovementioned, that traditional discussions on PPP have had the opposite direction, finding private capital to fund public investments. Lately, however, a few texts have appeared. This applies for instance to papers by Christoph Latteman et al. In such a paper, examples from Sweden, Great Britain and France are discussed [16]. However, cases in all European countries can be found. The conclusion in one of these papers is that the success rate of these projects increases if they do not only include push strategies but also include pull strategies. The pull strategy would entail focusing also on making services available that will lead people to take up broadband connections. This is fully in line with what has been presented in the present paper where the different policy measures available have been described. A coordinated policy approach encompassing a larger array of policy initiatives (supply as well as demand side oriented) will have a greater chance of success than a policy of merely putting public money into broadband extensions per se.

6 Conclusions

The question raised in the paper is how new network infrastructures for getting access to communication, information and entertainment services in the present and future information society will be funded. Two different avenues in the European discussions on this topic are examined. The first avenue is based on the universal service concept and its possible extension from telephony and PSTN to broadband access. The second avenue is based on alternative funding mechanisms and the wider range of available policy measures which can be taken into consideration. Both of these avenues can be seen as policies and measures to establish universal service – although it is only the traditional universal service conception, which is normally considered as such.

When looking first at the possibility to extend the traditional universal service concept to encompass broadband access, two issues are relevant. The first issue is whether broadband can live up to the criteria for imposing universal service policies on operators in the field. The second issue is concerned with the applicability of the universal service concept to the upcoming Next Generation Network infrastructures of communication networks. The basic criterion for imposing universal service requirements is that the network technology is used by a majority of the population and that a universal service effort is necessary to reach the remaining minorities of the population. As stated in the 2005 universal service review, mobile communications do not live on this criterion as mobile has already reached app. 100% penetration in most European countries. Broadband, on the other, hand was too little diffused in 2005 to be a technology that would exclude people if they did not have access. However, since 2005 broadband access has reached much higher rates of penetration. In the countries with the highest penetration – around 35% of the population – the household reach is more than 75% and it could be argued that broadband access, therefore, should made subject to universal service rules. However, the differences between countries are vast and there are also large discrepancies between urban and rural areas.

The other issue is how the universal service concept fits an NGN environment. With NGN, there is a separation between the infrastructural level and the service and application level. If users have access, they have access to many different services. Universal service will, therefore, have to shift from a specific set of services to access pure and simple.

The question is whether this will be implemented. The issue is that access can be delivered by means of many different technology solutions as described in the paper. This also means there is a greater degree of competition in the provision of broadband access than in the provision of PSTN access. The two things together, many different technology solutions and a greater amount of competitors, will be unlikely to lead to a situation where universal service requirements are imposed. The wide diffusion and de facto universal service will, therefore, have to rely on other measures: alternative funding mechanisms and a wider range of policy measures to expand broadband take-up.

In the paper, different available policy measures are listed, among them public investments in infrastructure build-out. Although public economic support for extending the infrastructure is not among the most highly prioritized means in a European context, it is a means which can be used and is used in cases, where private investors do not see a sufficient profitability, for instance in remote and rural areas. Also a combination of public and private initiatives is seen. Generally, public-private partnerships (PPP) are concerned with private initiatives in public policy areas, but in the context of extending broadband access, the issue is the involvement of public funds in an area which, since liberalization, has been a private investment area.

Other alternative funding mechanisms are also discussed in the paper. In addition to the investments of traditional telecommunications operators and public funding, there are investments by non-traditional operators, for instance utility companies (mostly in fiber), and by non-profit organizations. The range of many different investment sources takes the attention away from traditional universal service funding mechanisms and leaves the extension of broadband access to the competitive forces of the market and public investments where the market operators do not see a sufficient return on investment.

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