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SIVA

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"SIVA-South East Europe Improved Virtual Accessibility through joint initiatives facilitating the rollout of broadband networks"

POLICIES AND TOOLS FOR EFFICIENT DESIGN OF BROADBAND DEVELOPMENT

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The Lead Partner's note

Broadband is the fourth strategic pillar of the Digital Agenda for Europe. The connectivity and internet access it provides is a key enabler for a number of important services for citizens, businesses and the public sector. The ambitious targets set in the Digital Agenda indicate the importance of broadband for the economy of the EU and citizen welfare.

The SIVA project supports the goals of EU's strategy on digital technologies (namely the Digital Agenda for Europe) and aims to contribute to the improvement of virtual accessibility in South East Europe through the promotion of broadband access, supplementing physical accessibility and thus narrowing the digital gap in the SEE area.

The questions and issues that we attempted to resolve and address through the SIVA project were:

- What is the current digital map in our regions in respect to the developed European Regions?
- Are we contented with what the current picture is today?
- If not, how can we improve it?
- How would we be able to provide access to the citizens of mountainous or remote regions?
- In which way could we encourage entrepreneurship through broadband infrastructure?
- What are the most optimum and alternative investment schemes in both the public and private sector?
- Are we in a position to develop common tools and coordinate our actions within South East Europe?

The SIVA consortium (www.siva-project.eu) sets forward a series of recommendations that policy makers and national authorities in South East Europe are invited to consider in their efforts to promote broadband network deployment and diminish deployment costs:

Governance and strategic planning

- Limit the planning-to-implementation process gap.
- Authorize a central body to facilitate the coordination of civil works.
- Establish a centralized infrastructure data management platform.
- Spread knowledge among public officers and decision makers on the potential of infrastructure mapping and sharing.
- Legal and regulatory framework
- Transpose the relevant EU regulations and directives into national legislation.
- Establish control mechanisms to deal with high sensitivity infrastructure data.
- Pricing scheme that will provide the right incentives for incumbents to open up their facilities.
- Enforcement tools to ensure compliance with mapping and sharing regulations.
- Approaches to finance
- Co-financing through state aid and grant from the EU to overcome the resistances caused by the limited financial resources.
- Encourage public-private partnerships as a means for raising additional financing or as an alternative funding scheme.
- Collaborate with regions across EU to develop plans and projects for the deployment of high-speed broadband networks.

On behalf of the Administrative Board of the Regional Government Association of Western Macedonia (PED DM), I would like to express our profound joy and pleasure that such an important project was successfully finalized.

Sincerely

The President of PED DM

Vrizidou Paraskevi

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Introduction

In terms of telecommunication services and infrastructures, studies indicate a serious gap between the EU 25 and South East Europe (SEE). South East Europe has on average 154 internet users per 1.000 people, while the EU 25 figure is more than double. While all Member States and most regions in the SEE area have adopted virtual accessibility strategies to improve the situation, not all of those have set up comprehensive operational plans with mature implementing measures to achieve the objectives set. Moreover, the European Commission (EC) has recently pointed out that the European broadband connectivity targets for 2020 will be achieved only if regions commit to a common broadband policy and set out an operational plan defining national targets.

The reason the EC has given such attention on broadband development is that it has been proven that access to information is a prerequisite for development and competitiveness in Europe and thus, a condition sine qua non in the framework of the EU Cohesion Policy. Evidence shows that broadband connectivity and financing of virtual accessibility are key components necessary for the development, adoption and use of ICT in the economy and society. Accessibility to ICT, uptake and use of ICT is relevant not only for households and enterprises but also for public bodies for the provision of a large number of services. SEE is lagging behind in this demand. Transnational co-operation in this field is decisive in order to acquire the necessary critical mass for the development of the envisaged plans and tools.

The SIVA project (South East Europe improved virtual accessibility through joint initiatives facilitating the rollout of broadband networks) aims to make tangible structural long term changes on virtual accessibility strategies in the SEE territories. The consortium partners have worked towards defining ways to improve virtual accessibility and broadband planning strategies in the SEE regions exploring the quality of experience of broadband access users, developing tools for planning the most cost-efficient technological solutions to expand broadband coverage, and speeding the deployment of available infrastructure by promoting the idea of sharing them. The territories of the partners are determined to improve their capabilities in maximizing the use of available funds and encourage public private partnerships for investments towards making broadband accessible to all EU citizens.

Important steps to this end were to fill in the missing information by identifying bottlenecks and needs regarding the roll-out and take-up of broadband and digital public services in the SEE areas, and to facilitate the formulation of common priorities and strategies. Thus, actions were taken towards achieving a more thorough understanding of current broadband penetration, existing telecommunication networks, technical approaches and instruments used for planning and deployment of networks, passive infrastructures, operators, and their availability for being shared and commonly valorized. In addition an analysis took place on available digital public services on offer, including aspects such as technologies, types and quality of offered services and their impact and effectiveness on competitiveness, employment and growth. A report on the benefits and realization of the infrastructure sharing was conducted and an analysis

showcased the potential for converging regarding policy specifications and the landscape of policies in Europe and specifically the SEE area.

These actions were documented throughout the duration of the project in a series of deliverables. The chapters of this guide correspond to some of the important findings throughout the SIVA project.

Specifically the Chapter presents the findings of the assessment and comparative analysis of the level of broadband penetration and digital public services in Southeast Europe. Trying to produce knowledge resources and provide insights that will support informed decision making and strategy planning the study covered areas such as broadband penetration rates, coverage and types of networks, digital public services on offer, types and quality of offered services etc.

Same as above determines the impact created by increased broadband service provision and enhanced virtual accessibility in the SEE area with a focus on their impact on competitiveness, employment and growth. Examined areas included both direct benefits to end users, as well as indirect benefits arising from broadband provision, such as cost savings through e-government services.

Same as above presents basic facts about infrastructure sharing agreements that aim at the reduction of broadband deployment cost, complying at the same time with the general European competition rules. Special attention is given to the establishment of the rationale and the existing framework regarding sharing network agreements of broadband in the wider area of Europe.

Same as above builds on the previous analysis and proposes policy specifications which set a basis for decision making, strategic planning and collaboration schemes on virtual accessibility among public administrations in the SEE regions. The recommendations cover a wide range of policy relative areas such as regulatory measures, financial encouragement and demand stimulation. Furthermore, it provides a discussion of relevant European Union level policies for broadband, which serve as guidelines for national policy frameworks, an analysis of the relevant national policies, and specifications for proposed policy amendments that will help faster broadband penetration in SEE areas and in Europe.

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1) COMPARATIVE ANALYSIS OF BROADBAND PENETRATION AND DIGITAL PUBLIC SERVICES IN SOUTH EAST EUROPE

Produced by: Molise Region
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The benefits of broadband on society and the economy have been strenuously researched in the near past and still remain a topic of interest (ITU, 2012). Clear benefits on both fronts have been demonstrated by the penetration and use of broadband services by citizens and businesses. Societal benefits of broadband mainly stem from the fact that the existence of fast and ultra-fast internet provided individuals access to services that were unattainable before. This is especially crucial for citizens located in remote geographical areas or areas disadvantaged in terms of physical accessibility, such as mountainous areas, island, etc.

Virtual accessibility to services enabled by the use of broadband technologies is key in order to improve inclusion and equal access to services for all citizens. E-health, e-government, e-learning and other services that can be delivered virtually all contribute toward the increased efficiency and the improved inclusion of individuals who faced accessibility barriers prohibiting them from reaching the physical services (Atkinson, Robert ,Castro and Daniel, 2008).

Several studies, such as (ITU, 2012) and (Bouras, Diles, & Kokkinos, 2013), have focused on the economic impact of broadband. Both studies conclude that broadband exhibits a higher contribution to economic growth in countries that have a higher adoption of the technology and that the economic impact of broadband is higher when promotion of the technology is combined with stimulus of innovative businesses that are tied to new applications.

In addition, broadband has a stronger productivity impact in sectors with high transaction costs, such as financial services, or high labour intensity, such as tourism and lodging; while, the impact of broadband on small and medium enterprises takes longer to materialize due to the need to restructure the firms' processes and labour organization in order to gain from adopting the technology. All these factors cause a significant rise in Gross Domestic Product (GDP) as shown in work (Little, Glaumann & Bohlin, 2013).

This beneficial impact of broadband technologies has led several countries to adopt laws requiring the state to work to ensure that Internet access is broadly available and/or preventing the state from unreasonably restricting an individual's access to information and the Internet,

hence treating access to the Internet as a civil/human right. The European Commission (EC) has drafted the Digital Agenda for Europe as one of its flagship initiatives for Europe 2020, explicitly aiming to provide all citizens with the capability to access fast internet services by 2013 and ultra-fast internet by 2020 (Digital Agenda, 2013).

In this chapter we provide a comprehensive overview of the current state of affairs regarding broadband and e-Government services in seven South East Europe (SEE) countries (Austria, Bulgaria, Greece, Italy, Slovenia, Former Yugoslav Republic of Macedonia - FYROM, Montenegro) and to provide useful and usable information that could lead to suggestions for improvements and joint actions for policy makers that will, in turn, help improve the related policies in the SEE region.

1.1 Methodology

To satisfy the objectives of the project, SIVA partners created and delivered three suitable questionnaires. The main purposes of these surveys was to identify, measure and highlight the mismatches in broadband coverage and/or penetration that lead to the digital divide by collecting relevant information. In detail, the primary goal of the first survey was to measure the penetration of broadband networks and services in SEE area. The survey aimed to evaluate the current situation in all types of broadband networks. The questionnaire was organized in five directions as following: 1) Type of access to broadband technologies, 2) Pricing and usage, 3) Possible barriers, 4) The type of users and 5) Miscellaneous questions.

The second survey was created to map and catalogue the existing telecommunication networks, passive infrastructures and operators in SEE. This survey aimed to make a comparative analysis per country and identify possible obstacles that prevent their wide spread. To achieve all these, the questionnaire was organized in four areas: 1) Technology, 2) Quality of Service, 3) Operators, and 4) General Issues.

The primary goal of the third survey was to analyze the variety of digital public services put on offer in the selected regions of SEE. The survey aimed to measure the relationship between institutions providing digital public services on the one hand and citizens and business on the other. Of great importance was to analyze the variety of offered services, provide statistics about their usage and try to find out about any potentially innovative services throughout the regions.

The questionnaires for the first two surveys dealing with broadband were almost exclusively based on closed-ended questions in order to lead the respondents into providing detailed information about very specific indicators and metrics. The third survey related to e-Government services, adopted the opposite approach and developed a data collection form

based purely on open-ended questions, where each respondent had the freedom to provide information that he found relevant to the questions. The specific characteristics, the scope and the detail of the information were up to the respondent to decide.

The three questionnaires were filled by all partners. To complete the questionnaires desk research was used as a first step for each partner. In case of difficulties in the collection of data, each partner was free to use its own techniques: existing national/regional/ reports, interviews with stakeholders, questionnaires for the target groups. Finally, except for desk research, interviews with stakeholders were used alternatively.

1.2 Comparative analysis

A. Broadband offerings in SEE

1) Geographical coverage

Regarding geographical coverage, survey results show that fixed Digital Subscriber Line (xDSL) technology is the dominant technology in the region. All seven countries provide broadband services using xDSL. The data indicates that xDSL technologies are generally available to urban as well as rural regions. Low rural coverage for xDSL is encountered in Bulgaria at 24% and in Montenegro at 30%, while the other countries exhibit coverage above 78%.

Broadband offerings based on cable technologies are available only in Austria, Bulgaria and Slovenia. Their geographical coverage is quite low which seems to indicate that it remains a special purpose technology that has not reached widespread adoption in the region. Another interesting result is the significant adoption of fiber technologies. Fiber-To-The-x (FTTx) technologies are the next big thing in fixed broadband and their availability and massive adoption is expected to be the route toward meeting the goals of the EU Digital Agenda.

As far as the gap between geographical coverage in urban and rural areas is concerned, the only safe conclusion is that rural regions are lagging behind urban regions. This conclusion was expected given the smaller area and higher population density of urban areas which makes them a better market for providers as well as the characteristic of rural terrain in the countries of the SEE region. Despite this, most countries exhibit significant broadband geographical rural coverage.

Wireless broadband technologies are not widely available. The only technology that offers full coverage is satellite. The only other technology apart from satellite that features non-negligible geographical coverage is WiMAX (Worldwide Interoperability for Microwave Access). It is available in Austria, Bulgaria, Greece, Italy and Montenegro in coverage ranging from 8% to

60%. Broadband offerings based on other technologies, such as long-range WiFi, are not available in the region. Conventional WiFi seems to have a small geographical coverage in urban regions of Montenegro. The existence of hot-spots, where WiFi is offered using a fixed connection and a wireless router lies outside the scope of this research.

Mobile broadband services are becoming more popular with the introduction of technologies that can compete with the speed of wireless and fixed broadband services. High Speed Packet Access (HSPA) and HSPA+ technologies seem to be available in four countries of the SIVA consortium. Long Term Evolution (LTE) is currently being introduced. Its current limited coverage is a result of the early stages of market maturity of the technology. Technologies belonging to the Code Division Multiple Access (CDMA) family are not used at all in the area of South East Europe. Historically this region has been using 3rd Generation Partnership Project (3GPP) technologies and due to legacy systems and infrastructure this is not expected to change.

The nature of mobile technologies makes the gap in the geographical coverage between urban and rural areas much smaller. Country level comparisons are also quite interesting in the case of mobile broadband technologies. Austria and Montenegro feature significant diversification in the technologies used to offer mobile services. Italy and Greece on the other hand offer the fewest technology options.

2) Average download bandwidth

Regarding the actual average download bandwidth that is achieved in the seven countries per technology, survey results show that the differences between countries for the same technology family are staggering. For example, cable broadband services deliver 100Mbps in Italy and only 2Mbps in Montenegro. Reported bandwidths for FTTx connections can range up to almost a factor of four, 100 Mbps in Greece and only 27Mbps in Slovenia. For mobile broadband the range is even larger, bandwidths as low as 2 and as high as 42 Mbps are reported.

3) Prices of retail offerings

Concerning the prices of retail offerings, it is interesting to note that some countries with a small per capita income, like Montenegro, have very high prices for fixed broadband, while Austria with a high per capita income enjoys much lower prices. This may be attributed to the operation of the local markets and the specific conditions, but such discrepancies prohibit the proliferation of broadband services to areas with lower penetration. Montenegro and Slovenia have the highest absolute prices between the seven SIVA countries. Bulgaria has by far the lowest prices.

Assuming mobile services, most broadband packages come with a 1GB download quota, independently of the technology used to deliver the service. It is interesting to note that the variance of mobile broadband prices is lower than that of fixed broadband. Citizens of most countries can purchase mobile broadband services for 8-12 euro per month. The two exceptions to this are Greece and Montenegro where prices are relatively much higher.
Unlimited broadband plans are available in all countries for fixed broadband offerings. Mobile broadband offerings, on the other hand, do not include unlimited usage rights ubiquitously. Partners from Greece, Italy, Montenegro and Slovenia have reported the existence of unlimited usage plans, while partners from Austria, Bulgaria and FYROM report the lack of such plans. Given that mobile broadband is one of the main ways of proliferating broadband services in rural areas and especially those with geographical particularities, the lack of unlimited usage mobile broadband plans may become an obstacle for the bridging of the digital divide and the enhancement of virtual accessibility.

B. Barriers for broadband penetration

Survey results show that broadband deployment is mainly held back by market related reasons, and secondarily by technical reasons. The most recognized barriers are related to the high cost of capital for funding for network development, the high cost of user terminals and the lack of demand for such services. Technical barriers that also hinder deployment are the lack of existing infrastructure and the lack of power supply to operate the required infrastructure. These two classes of barriers are dominant in all countries of the SIVA consortium. Additional barriers, geographically limited, also exist. For example, in Slovenia there seems to be a lack of strategy from the government and unwillingness of local authorities to cooperate with broadband vendors. Greece has identified the lack of skilled personnel for the construction, maintenance and operation of the network infrastructure as a barrier.

C. Competition in the SEE broadband market

Survey results show that there is indeed competition in the broadband market in all SIVA countries (between 5 and 9 telecom operators and/or internet service providers in each country). This situation may not represent conditions of perfect competition, but it is far from monopoly (or even oligopoly) situations, where service pricing is determined primarily by factors other than supply and demand. Another interesting conclusion is that the operators share infrastructure in all the countries of the project. This is essential for the reduction of the cost base of the operators offering broadband services.

D. Profile of broadband users

Broadband penetration in citizens who have completed elementary school is low in countries

such as FYROM, Montenegro, Greece and Bulgaria. In Austria and Slovenia the percentage exceeds 50% and can be considered adequate. Penetration in citizens who have completed secondary education, on the other hand, may be deemed satisfactory in all countries except Bulgaria. More than half of citizens of this class use broadband services, presumably more will be using the internet and other digital services though narrowband connections. Generally, the percentage of broadband users increases as citizens become more educated.

In the survey questionnaire internet usage was classified under five discrete activities: communication, finding information, fun, work and other. Communication and finding information seem to be the most popular activities. Most reported information is well above 60% for these activities. This is well motivated as this type of services has been available for some time and users are accustomed to them. One surprising finding is the percentage of broadband users who use the internet for work. With the exception of Slovenia, all other countries have reported percentages ranging from 30 to 8%. It is not clear whether this is due to the lack of need for internet for work-related purposes or whether individuals who need to access the internet for work have other means to do so. Slovenia reports a percentage of 80% on the other hand, which is quite high.

Another finding is that gender is not an important parameter in determining whether individuals will purchase goods or services online. The percentages for males and females are almost identical in both cases. A second interesting conclusion is that the percentage of Austrians and Slovenians that purchase goods or services online is much higher compared to the rest countries where the percentage is surprisingly low, less than 10% of broadband users seem to purchase either goods or services online.
As expected, broadband users in Austria, Greece, Italy and Slovenia exhibit on average a higher probability to purchase a range of different products and services online. Bulgaria, FYROM and Montenegro have much lower figures. Sports equipment is the goods type that most broadband users prefer on average, while electronic devices, books/magazines, travel/hotel reservations are also very popular on average.

1.3 Comparative analysis of e-government services

The five-stage maturity model classifies how businesses and citizens can interact with the public authorities into five discrete levels (Budinoski, Trajkovik, 2012). Governments' service delivery processes are described according to the following stages: 1) information, 2) one-way interaction, 3) two-way interaction, 4) transaction, and finally 5) targetization. Sophistication stages are depicted in Table I. Until 2007 each elementary service was graded on a scale from zero to four. In 2007, the EC introduced a new 5th stage, which refers to the personalisation of services.

Table I. Level of sophistication of e-government services

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Information	**One-Way Interaction (Downloadable Forms)**	**Two-Way Interaction (Electronic Forms)**	**Transaction (Full Electronic Case Handling)**	**TARGETIZATION (pro-active and automated)**
0-20 %	20-40 %	40-60 %	60-80 %	80-100 %
The information necessary to start the procedure and obtain a public service is available online.	The publicly accessible website offers the possibility to obtain in a non-electronic way (by downloading forms) to start the procedure and obtain this service.	The publicly accessible website offers the possibility of an electronic intake with an official electronic form to start the procedure and obtain this service.	The publicly accessible website offers the possibility to completely treat the public service via the website, including decision and delivery.	The government pro-actively performs actions to enhance the service delivery quality. Data is reused. There is no need for the user to request the service.

The third and the fourth levels, two-way interaction and transaction, have become a standard for many countries: electronic forms are available for many services; the transactional approach (also known as full electronic case handling), where the user applies for and receives the service online, without any additional paper work, is increasingly becoming mainstream. The fifth level provides an indication of the extent by which front and back offices are integrated, data is reused and services are delivered proactively. The fourth and fifth levels are jointly referred to as 'full online availability'.

Using this model, the basic public services are being monitored on behalf of the EC in order to establish the progress of e-Government in different countries. These services have been defined and monitored according to the suggestions explained in (Capgemini, Rand Europe, IDC, Sogeti, & DTi 2009, 2010a, 2010b). Most of the basic services focus on the interaction between the state administration and citizens, while some of them aim at facilitating the communication between government institutions and the business community.

Table II. Sophistication level graded according to the five-stage maturity model for e-government services to citizens source: epractice.eu, SIVA survey on digital public services in see (2013)

Service		Austria	Bulgaria	FYROM	Greece	Italy	Montenegro	Slovenia
Income taxes: declaration, notification of assessment		4	2	0	4	4	2	4
Job search services by labour offices			3	3	3	1	0	1
Social security benefits	Unemployment benefits	1	1	0	2	2	0	2
	Child allowances	2	1	0	1		0	2
	Medical costs		1	0			0	
	Student grants	4	1	2	1	1	0	1
Personal documents	Passport	2	1	1	1	1	0	1
	Driver's licences		1	0	2	1	0	2
Car registration			1	0	2		0	2
Application for building permission		3	1	0	1		0	3
Declaration to the police		2	1	0	1	2	0	2
Public libraries		1	1	0	3	1	0	1
Certificates: request and delivery			1	1	3		0	4
Enrolment in higher education/university		3	1	0	1	3	0	2
Announcement of moving		2	1	0		1	0	2
Health related services			1	0	1	3	0	3

Table II presents the current level of sophistication of the government-to-citizens services offered in the SIVA countries according to the five-stage maturity model. It is important to mention that some of these services are actually irrelevant in certain countries. For instance, a service for the reimbursement of medical costs to citizens may not be relevant when citizens receive free medical treatment. The sophistication level of the digital public services offered to businesses in the SIVA countries is illustrated in Table III.

Table III. Sophistication level for e-government services to businesses across the siva consortium countriessource: epractice.eu, siva survey on digital public services in see (2013)

Service	Austria	Bulgaria	FYROM	Greece	Italy	Montenegro	Slovenia
Social contributions for	4	2	1	2	3	0	4
Corporate tax: declaration,	4	2	2	4	3	0	2
VAT: declaration, notification	2	2	0	4	3	0	2
Registration of a new	1	1	2	2	3	2	2
Submission of data to	2	2	0	2	2	0	2
Customs declarations		2	4	4	4	0	4
Environment-related permits (incl. reporting)	4	1	0	1	1	0	3
Public procurement	2	1	4	1	4	0	1

Finally, Table IV illustrates the combined sophistication of the e-Government services offered to both citizens and businesses across the SIVA countries. This score is calculated as the average level of relevant services in the country, based on the numbers in Tables II and III per country. Obviously the higher this number is the more sophisticated the digital public services in the country are, on average. The rows with normalized percentages, normalizes the average sophistication scores to a percentage according to the guidelines of Table I. The maximum (100%) would correspond to all relevant services being offered at the targetization level (5).

This single indicator per country helps us to compare the progress of the different countries using a common benchmark that has been agreed on. The conclusion from Table IV is that Austria has by far the most advanced e-Government services for its citizens among the SIVA countries, while Italy, Slovenia and Greece offer a certain level of digital services that goes, on average, beyond pure online information availability. Bulgaria, FYROM and Montenegro have to make a significant effort to develop services for their citizens and catch up.

Table IV. Average sophistication Level of e-Government services for Citizens and Businesses

		Austria	Bulgaria	FYROM	Greece	Italy	Montenegro	Slovenia
For citizens	Average level	3.43	1	0.58	1.86	1.81	0.12528	2.13
	Normalized percentage	68.6%	20%	11.6%	37.2%	36.2%	2.5%	42.6%
For businesses	Average level	2.71	1.63	1.63	2.5	2.88	0.25	2.5
	Normalized percentage	54.2%	32.6%	32.6%	50%	57.6%	5%	50%

The scores in Table IV show that Italy has the most advanced e-Government services for its businesses, while Austria, Greece and Slovenia follow with slightly less scores. In this case too, Bulgaria, FYROM and Montenegro present the lowest levels of sophistication of the government-to-businesses services. Especially Bulgaria that is an EU member state should invest heavily on such services in order to come to par with the standard of other member states. A comparison between citizens and businesses levels reveals that on average digital public services for businesses are more sophisticated than those for citizens.

1.4 Policy recommendations

According to the Digital Agenda Scoreboard (European Commission, 2013), all SIVA countries lag behind the EU average both in terms of broadband population coverage as well as sophistication of e- Government services (Figure 1). Significant progress on both fronts is urgently required in order to improve virtual accessibility of citizens and businesses.

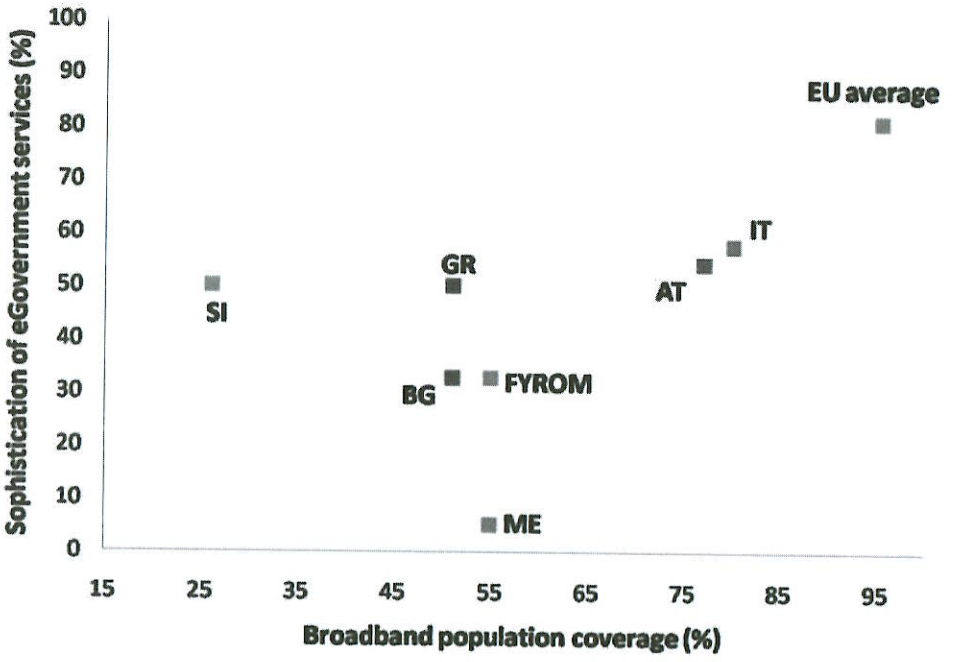

Figure 1. e-Government sophistication vs. broadband penetration comparative situation in SIVA countries, Sources: SIVA surveys on broadband penetration and digital public services, Digital Agenda Scoreboard.

Moreover, the digital divide continues to exist both between urban and rural regions as well as between SEE countries. Bridging this gap will require significant and coordinated efforts from EU, national and regional authorities; it is an undertaking that cannot be handled in isolation due to its cost and complexity.

At the policy level, two main areas of intervention will unlock improvements in broadband penetration rates and boost the economy and social inclusion of inhabitants of digitally underprivileged areas. The first area concerns the stimulation of supply of broadband services to citizens and business and the second involves the stimulation of demand.

Area 1: Provide resources and foster the environment for deployment of NGA network infrastructure

- Funding for infrastructure deployment, especially in rural areas targeting the narrowing of the digital divide

Most public broadband infrastructure investments are funded using EU resources from the social, development and cohesion funds. Extending the infrastructure to fully cover rural areas is very costly and national budgets cannot fund it on their own (Hätönen, 2011). In

combination with the shrinking budget that the EU is allocating to the aforementioned funds from this year on, infrastructure development is expected to suffer significantly. It is apparent that a wide deployment of broadband, and especially NGA networks, relies on the will of the EC to allocate significant funds toward this end.

- Improve national regulation frameworks

The EU has published several directives on how to improve the national regulations to promote competition in the broadband market and to provide sufficient choice of high-quality services to consumers. Public administrations are asking the EU to support them with more guidance on concrete measures and simplified procedural requirements for next generation networks. NGAs are a recent development and not every public administration possesses the know-how to fine-tune its regulation. Establishing a proper regulatory framework that will stimulate competition on fair grounds is of paramount importance for the survival of the broadband market.

- Draft national/regional broadband strategies to foster a stable environment for broadband related investments

Even if broadband infrastructure is available, telecom operators are the ones who will offer broadband services to citizens and businesses. They should expect a satisfactory return-on-investment in order to invest in a new country or territory and offer services to the public. The relevant national authorities should provide a stable and inviting environment for broadband-related investments and service deployment through the establishment of national broadband plans, and perhaps corresponding financial incentives.

Area 2: Improve citizens' digital skills

To achieve the Digital Agenda goals and achieve social inclusion for all, broadband services should become accessible, affordable and usable by citizens throughout the EU. Accessible and affordable are mostly dependent on parameters outside the individual's influence. Usable, however, refers to the fact that citizens must possess the fundamental skill set to be able to use broadband services and take full advantage of their existence. Education, training and awareness raising actions on behalf of national authorities and the EU are necessary to improve citizens' digital skills. The results of the surveys analyzed in this document clearly illustrate that citizens in the countries of the SIVA project are not taking advantage of the capabilities of broadband services. Traditional usage of the internet, like information finding and news reading, may be adequate; novel uses however, including e-commerce, e- government, are not adopted fast enough. This leads to a perception that fast and ultra-fast internet do not offer additional utility to users, hence lowering demand and discouraging private vendors from investing toward their provision due to limited demand. Training the public on how to leverage

these services to increase their productivity and their access to goods and services will stimulate demand and kick-start a virtuous circle toward the proliferation of broadband and the achievement of the Digital Agenda targets.

1.5 Conclusions

In this chapter, we comparatively assessed the current situation in seven SEE countries regarding broadband availability and characteristics as well as digital public service provision by public administrations in the SEE region. It became apparent that the digital divide is strong both within countries, between urban and rural regions, as well as among countries of SEE. Significant interventions will be required for the stimulation of supply and demand of broadband services in order to expand their reach and achieve the desired benefits of social inclusion and economic boost.

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1.7 Abbreviations

3GPP	3rd Generation Partnership Project
CDMA	Code Division Multiple Access
CoR	Committee of the Regions
DAE	Digital Agenda for Europe
DSL	Digital Subscriber Line
EC	European Commission
EU	European Union
FTTH	Fiber-To-The-Home
FTTx	Fiber-To-The-(Building/Curb/Home/Premises)
FYROM	Former Yugoslav Republic of Macedonia
GB	Giga Byte
GDP	Gross Domestic Product
HSPA	High Speed Packet Access
ITU	International Telecommunication Union
ICT	Information and Communication Technologies
Kbps	Kilo bit per second
NGA	Next Generation Access

LTE	Long Term Evolution
Mbps	Mega bit per second
SEE	South East Europe
SIVA	South East Europe improved virtual accessibility through joint initiatives facilitating the rollout of broadband networks
UMTS	Universal Mobile Telecommunications System
VAT	Value Added Tax
WiMAX	Worldwide Interoperability for Microwave Access

2) IMPACT OF BROADBAND ON ECONOMY

Produced by University of Patras
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Access to information, broadband connectivity and financing of virtual accessibility are key components necessary for the development, adoption and use of Information and Communication Technologies (ICT) in the economy and society. Inadequacies in the telecommunication infrastructure and accessibility to services among the individual countries and regions of the South East Europe (SEE) area hamper significantly competitiveness and cohesion in SEE' countries. Market mechanisms fail to address adequately the low population density and/or rural and remote areas. These problems have been widely acknowledged at European and national policy level. Member states and regions in the SEE area have adopted virtual accessibility strategies, but further work needs to be done particularly in elaborating comprehensive operational plans and mature implementing measures to achieve the objectives set regarding the broadband connectivity and accessibility of services.

However, in order to examine and promote policies to tackle the digital gap emerging between SEE areas and the rest of Europe, and among SEE areas as well, large investments are required for infrastructures, operational costs and other subsequent expenditures. This raises the question if there is a repayment and how much this is, in terms of local economy development, employment increase and other possible cost savings that will justify the significant initial investments.

Unfortunately, measuring broadband's impact is a quite difficult task. Broadband is a general purpose technology, which means there is no specific output, that it would be easy to measure. Instead, it affects multiple aspects of our professional and personal lives, in multiple ways. Moreover, in the countries under investigation, broadband large-scale penetration is recent or even expected in the near future. This means that the actual effects have not been either expressed or documented. Another consequence of broadband's general purpose nature, is that the effects become visible a long period of time after its ignition cause. This means that investments in infrastructure or a significant increase in broadband penetration may influence the economy of the area the next two or three years making the identification of the correlation difficult. Changes in employment are also difficult to trace since demand in one area may create a migration (or outsourcing) trend from other areas, or vice-versa.

The biggest problem however, in calculating accurately broadband's effects is the severe lack of data for many countries related to broadband and inter-sector economic dependencies that would allow for reliable investigation of the subject. Few countries have the means and the motivation to collect and analyze the data needed for the task, since it requires data for many variables and for an extended period of time.

Due to this problem, the largest portion of the bibliography has focused on high developed countries. The report in (Katz, 2012) was conducted under the provision of International Telecommunication Union (ITU) and constitutes a collective presentation of the research to date and policy issues on the subject highlighting the general conclusions of the past and ongoing research. The report discusses the parameters each study was based on, and compares the results of each study attempting to justify the diversification between the papers' results. The study in (Katz, Vaterlaus, Zenhausern and Suter, 2010) investigates the macroeconomic impact of investment in broadband technology on employment and output of Germanys economy, showcasing the longer term externalities of infrastructure investments, such as accelerated innovation and new business creation, as well as their possible role as economic stimuli in the present times of economic crisis. The effect on employment is also investigated, including direct positions that are created for construction and maintenance of the network (engineers, technicians, workers, etc.), indirect jobs created in sectors connected to the infrastructure, like electronic equipment manufacturing and induced employment that reflects the increased household income.

The work in (Qiang and Rossotto, 2009) applied regression analysis on data collected for a period of time starting from 1980 and onwards, separating high with low income countries. The analysis concluded that the empirical findings confirm that broadband's benefits in growth are major and robust for both developed and developing countries, although the significance is higher for the former, which have a longer track record of broadband diffusion. Similar results were obtained by (Koutroumpis, 2009) investigating 22 Organisation for Economic Co-operation and Development (OECD) countries, finding a positive correlation in growth and broadband penetration. The results also showed that the positive impact of broadband was greater when a critical mass of infrastructure was present, thus developed countries harvested the most benefits from broadband. US state-level data were used to estimate direct and indirect benefits on state Gross Domestic Product (GDP) in (Thompson and Garbacz, 2008). The phenomenon called "capital labor substitution" was also studied.

The latter means the loss of jobs because of the efficient utilization of broadband services. This effect varied between different locations and sectors, with the greater impact to be observed in less developed countries and sectors like accommodation. The work in (Fornefeld and Delaunay, 2008) showed that this effect becomes less evident in countries where innovation is encouraged, and new services are quickly embraced. When this is the case, broadband

deployment may boost innovation and the creation of new ideas of services, products and applications resulting in the growth of their respective fields, such as e-commerce, social networking etc. This development results in an increase in employment due to broadband which compensates for the reduction of lost jobs because of the capital labor substitution effect. Works Crandall, Lehr and Litan, 2007) and (Gillett, Lehr, Osorio, and Sirbu,2006) studied the effects on USA output and employment as well, showcasing a positive link between broadband and economy.

In this chapter, we investigate the impact of broadband on the growth and employment in SEE countries, namely Austria, Bulgaria, the former Yugoslav Republic of Macedonia (FYROM), Greece, Montenegro, Slovenia. Specifically, we define the macroeconomic evidence required for the analysis. We then enforce regression analysis on data collected by the respective countries in order to find the correlation between broadband, growth and employment. The period of the examination was set to be the last decade in order to obtain an extended amount of data, and take into account possible influences on the results by the economic crisis and the subsequent recession of the last years in the area. We also estimate the cost savings to companies and the state by the usage of broadband-based e-government services. We then forecast these benefits to 2015 when the respective countries are expected to have reached the e-government usage level which is set by the European digital agenda (Digital agenda, 2013).

2.1 Regression analysis

In statistics, regression analysis is a statistical technique for estimating the possible relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps one understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Most commonly, regression analysis estimates the conditional expectation of the dependent variable given the independent variables - that is, the average value of the dependent variable when the independent variables are fixed. In all cases, the estimation target is a function of the independent variables called the regression function. In regression analysis, it is also of interest to characterize the variation of the dependent variable around the regression function, which can be described by a probability distribution (Regression analysis, 2013).

Regression analysis is widely used for prediction and forecasting. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. In restricted circumstances, regression

analysis can be used to infer causal relationships between the independent and dependent variables. In this report, we use the technique with both aforementioned purposes.

At first, we investigate the causality between broadband provision and infrastructure to growth, employment and externalities and then we try to forecast the impact of future scheduled broadband plans to these variables for the next years. However, there is high probability that correlation of two events may not imply causation, instead it may suggest that both events are associated to and caused by a third event. This can lead to illusions or false relationships, so caution is important. As we have stated, another problem is the bi-directional causality between broadband provision and growth. In the model we consider broadband the independent and growth the dependent variable. However, in reality, a stronger economy affects broadband policies too, thus the bi-directional nature of the variables, which is, unfortunately difficult to model.

The performance of regression analysis methods in practice depends on the form of the data generating process, and how it relates to the regression approach being used. Since the true form of the data- generating process is generally not known, regression analysis often depends to some extent on making assumptions about this process. Classical assumptions for regression analysis include:

- The sample is representative of the population.
- The error is a random variable with a mean of zero conditional on the explanatory variables.
- The independent variables are measured with no error.
- The predictors are linearly independent.
- The errors are uncorrelated.
- The variance of the error is constant across observations.

These assumptions are sometimes testable if many data are available. Regression models for prediction are often useful even when the assumptions are moderately violated, although they may not perform optimally.

Regression models predict a value of the variable *Y* given known values of the variables *X*. Prediction within the range of values in the dataset used for model-fitting is known informally as interpolation. Prediction outside this range of the data is known as extrapolation. Performing

extrapolation relies strongly on the regression assumptions. The further the extrapolation goes outside the data, the more room there is for the model to fail due to differences between the assumptions and the sample data or the true values.

2.2 Methodology

Due to the lack of known inter-sector dependencies that would allow calculating multipliers to measure the impact, we considered regression analysis as explained above. In our study, we considered linear regression, for two reasons. The amount of data was insufficient to examine correlation with high complexity. The second reason is that based on the past research works, effects on broadband seems to saturate and are neglected for very high levels of penetration in developed countries. This situation is not representative of the SEE area that we investigate in this report, thus the linear model was rated adequate. The impact on growth was determined based on data collected for the period of 2001-2011 when available. The dependent variable was chosen to be the GDP per capita, and the independent the number of broadband internet subscribers per 100 people ($Broad_{pen}$). Our analysis was based on the model followed by (Qiang and Rossotto, 2009) and (Koutroumpis, 2009). Specifically, *Eq. 1* was used:

$$\log(GDP_{pc})P = \alpha_0 + \alpha_1 * \log(Broad_{pen}) + \alpha_2 * \log(Edu) + \alpha_3 * \log(Invest) \quad (1)$$

where GDP_{pc} denotes the GDP per capita, *Edu* is the percentage of school enrolment in primary education, and *Invest* is expressed through the Gross fixed capital formation (as a percentage of GDP).

Our goal is to estimate the coefficient of the "broadband internet subscribers per 100 people", i.e. the coefficient α_1. This estimation will allow us to track changes in GDP when broadband penetration changes; while the remaining parameters remain the same. Specifically, if $Broad'_{pen}$ and GDP'_{pc} are the new values of broadband penetration and GDP per capita respectively, the corresponding change in GDP would be:

$$\frac{GDP'_{pc}}{GDP_{pc}} = \left(\frac{Broad'_{pen}}{Broad_{pen}}\right)^{\alpha_1} \quad (2)$$

To calculate the impact on employment, the dependent variable was chosen to be the total employment of the country expressed as a percentage of the total labour force (*EMP*) and the independent variable was the number of broadband internet subscribers per 100 people ($Broad_{pen}$). Our analysis was based on the model in (Crandall, Lehr and Litan, 2007), and is shown in the following equation:

$$EMP = b_0 + b_1 * Broad_{pen} + b_2 * Edu + b_3 * Wage + b_4 * TAX \quad (3)$$

where *Wage* denotes the average wage in the country, *TAX* expresses the taxes on income, profits and capital gains (as a percentage of revenue), and *Edu* denotes again the percentage of school enrolment in primary education.

Here, our goal is to estimate the coefficient b_1 that will allow us to track changes in employment when broadband penetration changes; while the value of the remaining parameters stays the same. In this case, if $Broad'_{pen}$ and EMP' are the new values of broadband penetration and employment respectively, the corresponding change in employment would be:

$$EMP' - EMP = b_1 * (Broad'_{pen} - Broadpen) \quad (4)$$

Finally, we evaluated the positive externalities derived by the utilization of broadband-based e-government services. Indirect benefits of broadband are difficult to measure. As already stated, broadband is a general purpose technology, affecting many economic aspects. Probably, the most important externality is the cost reduction to end-users, companies and state, through broadband facilitated services. These include saving work hours, reducing travel costs etc.
E-government allows for effective, fast and most importantly cost-effective method of public administration and user-government and business-government interaction. Saving work hours through e-government services is a large portion of the cost reduction that is attributed to broadband. Companies save millions of work hours, the state reduces the cost relative to traditional methods of transactions, and citizens both harvest the above benefits, plus save money through postage burdens, travel reduction, working hours etc.

To estimate the money each country may save by increased e-government, we followed the process defined in (E. D. I. Society, 2004) and (L. Frontier Economics Ltd, 2010). Specifically, we evaluated the costs that are saved by each country when three of the most common transactions i.e. income tax, VAT and business registration are conducted online, instead of the traditional way. At first we estimated the total number of these transactions that were conducted in a year. Since, those statistics were not available for the countries under investigation, we used the number of transactions that were available for other European countries and adjusted the number to the population of the countries of the consortium. We multiplied the total number of transactions ($\#Trans_{tot}$) with the percentage of e- government usage of each country ($egov_{per}$), to estimate the total number of transactions that were conducted online within a year ($\#Trans_{online}$), i.e.:

$$\#Trans_{online} = egov_{per} * \#Trans_{tot} \quad (5)$$

We then calculated the total time saved using e-government services per year, by multiplying the number of online transactions within a year with the time save by each one of them (61

minutes per transaction, according to (E. D. I. Society, 2004) and (L. Frontier Economics Ltd, 2010):

$$TimeSaved(min)=61 * \#Trans_{online} \quad (6)$$

The next step in our analysis was to express the time saved in equal working years. To this direction, we considered a working year to contain 240 working days, and each working day of 8 working hours (*Eq. 7*). Finally, we evaluated the total money saved per year based on the average annual wage in the country examined and the time saved (*Eq. 8*).

$$TimeSaved(yrs)=TimeSaved(min)/(240 * 8 * 60) \quad (7)$$

$$Money_{saved}=(8)\ TimeSaved(yrs)*Wage_{annual} \quad (8)$$

After our evaluation, we forecast the potential savings due to e-government when the goals set by the European digital agenda on e-government services are reached. That is, 50% of the population will be using e-government services by 2015. It is noted that our estimations were based on a fraction of the total transactions possible, and our final cost reduction did not include the money saved by the reduction of travelling or postage requirements due to e-government. Thus, the estimation should be considered a conservative estimate of the resulting cost savings.

2.3 Experimental results

2.3.1 Impact on Growth

Below we present the findings of the regression analysis, regarding the impact of broadband on the countries' GDP. The analysis yielded the dependencies depicted in Table V. The positive link between broadband and growth is reflected through the broadband coefficient a_1 which was found positive for all countries. Parameter R^2 denotes how well the calculated line by the regression fits the measured data. Values of R^2 close to 1, as is the case in our results, show very good fitting.

Table V. Regression Statistics on Growth.

Country	a_0	a_1	a_2	a_3	R^2 stat
Austria	2.5816	0.0768	0.9427	0.0123	0.8931
Bulgaria	-1.6938	0.0561	2.4604	0.0642	0.9321
FYROM	0.3753	0.1554	1.1710	0.6472	0.9848
Greece	0.3934	0.0259	1.6583	0.3084	0.9291
Montenegro	6.4629	0.0487	-1.7419	0.2815	0.9174
Slovenia	1.3640	0.1985	-0.4105	0.3836	0.8940
Italy	0.6101	0.1193	1.7306	0.2264	0.6281

The practical meaning of the findings is depicted in Figure 2 where we calculate the impact on growth when broadband penetration is assumed to increase by 10% (and all other parameters are assumed constant). The impact ranges from 0.2 to almost 1.9% increase in GDP and GDP per capita. Slovenia exhibits the greatest benefit of all countries. It also has the biggest penetration, which implies that there may indeed be a link between the level of penetration and the severity of broadband impact. However, several other parameters play their role, since FYROM being the second in growth impact, has a penetration rate of just 8.5%.

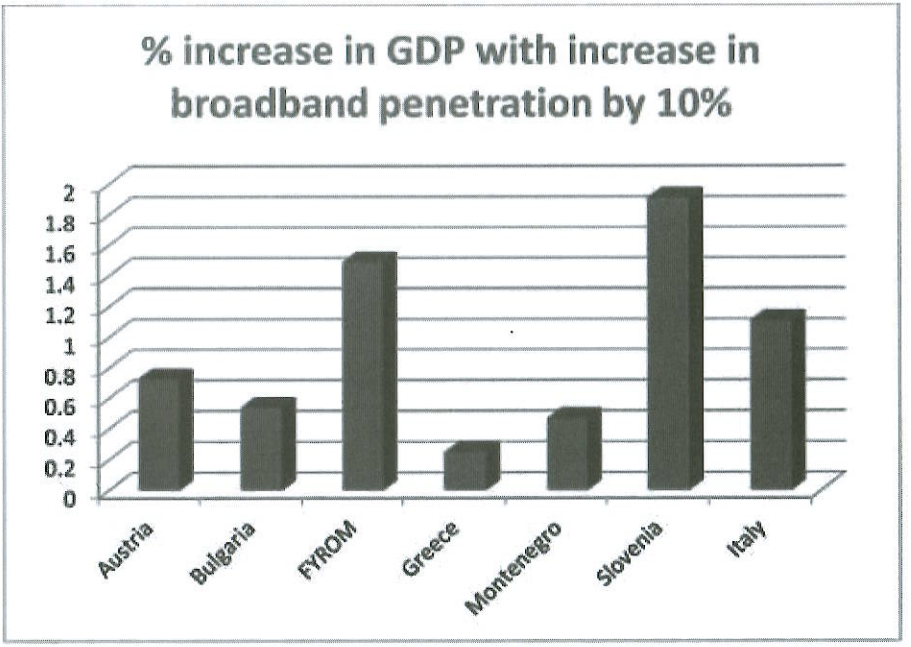

Figure 2. Percentage of GDP increase for 10% broadband penetration increase

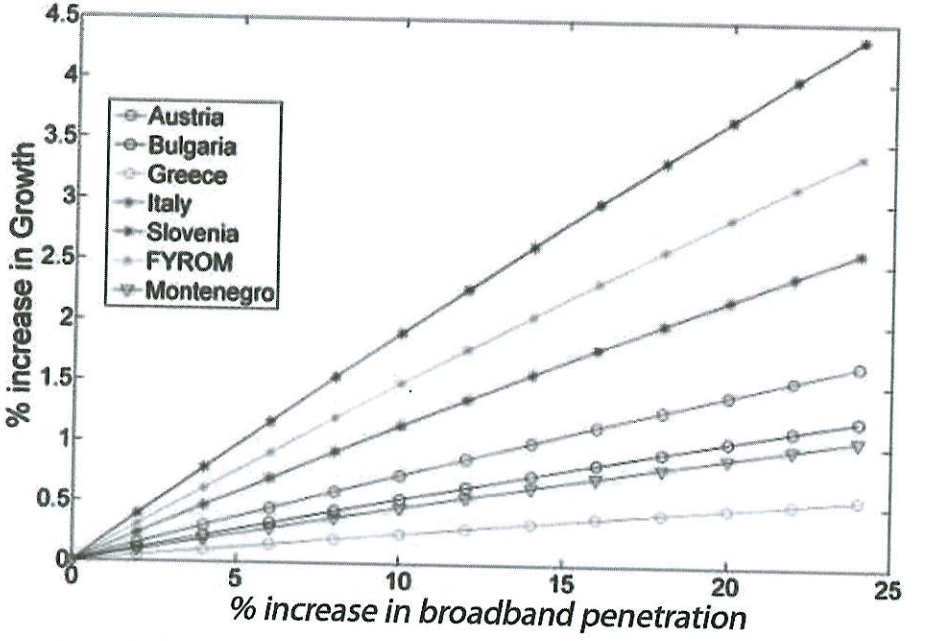

Figure 3. % increase in GDP as a result of the corresponding % increase in broadband penetration, when all the other variables are considered constant

Using Eq. 2 to depict GDP growth versus broadband penetration when all other variables are considered constant, results to Figure 3. In the figure we show the % increase of growth for different percentage increase in broadband penetration. The slope of the curves correspond to the $(Broad_{incr})^{a1}$ value for each country, where $Broad_{incr}$ denotes the % increase of broadband penetration. Besides the adequate time needed to fully reveal its impact and the complex dependencies that broadband exhibits in the economy, the positive stimulation of broadband on growth of SEE areas is evident, and it should be considered as an attractive candidate for boosting economic development.

2.3.2 Impact on Employment

In this section we present the findings yielded by the regression analysis on employment. Table VI shows the factors obtained by the analysis where possible. As the table suggests, the results were inconclusive. Three of seven countries examined, showed positive overall correlation between broadband and rise of employment (positive broadband penetration coefficient), though the findings and the parameters of the research (i.e. data availability) were not adequate for safe results. This is more evident in Figure 4, where we substitute coefficient b_1 found for each country in *Eq. 4*. The figure depicts the theoretical connection between

broadband increase and the corresponding change in employment, when all other variables are considered constant.

Table VI. Regression Statistics on Employment.

Country	b_0	b_1	b_2	b_3	b_4	R^2 stat
Austria	11.5979	0.0101	-0.0371	0.0010	0.4415	0.8368
Bulgaria	100.3273	-0.5312	-0.8837	0.0022	2.0397	0.9268
FYROM	0	0.3006	0.2481	0.0004	0.4915	-
Greece	71.8160	-0.3014	-0.3982	0.0013	-0.3502	0.9842
Montenegro	-	-	-	-	-	-
Slovenia	40.3993	0.0596	0.0072	0.0004	0.3453	0.8570
Italy	76.6873	0.0915	0.3155	-0.0020	0.1341	0.6282

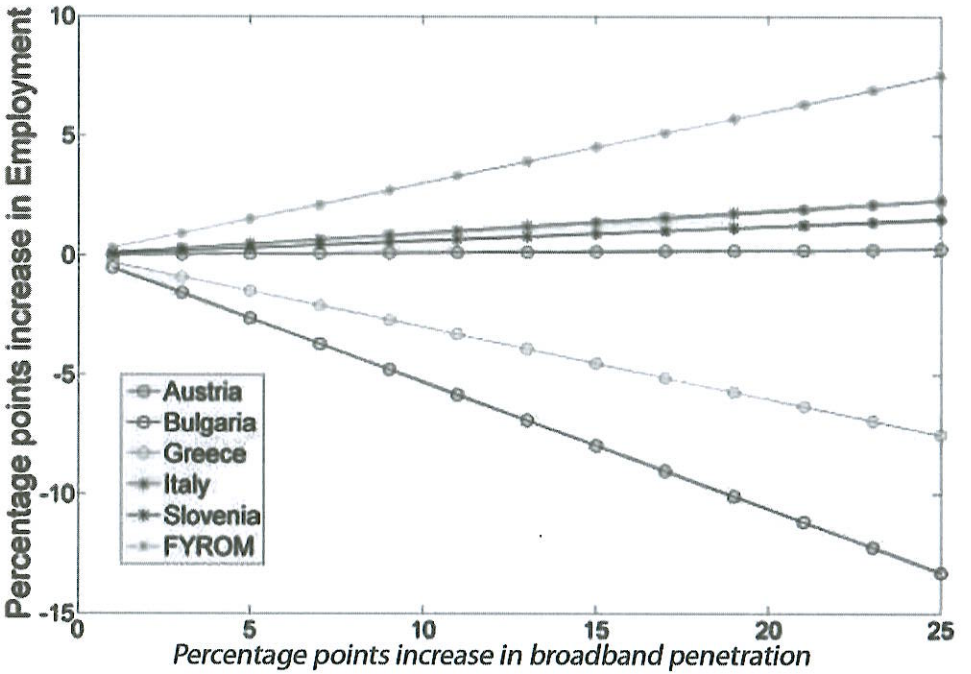

Figure 4. Percentage points increase in employment as a result of the corresponding percentage point's increase in broadband penetration, when all the other variables are considered constant

Besides the insufficient amount of data that did not allow us to cover every country, the analysis did not reveal a common trend between employment and broadband provision. Apart from the immediate creation of jobs for infrastructure building and maintenance, several phenomena

such as outsourcing, tele-working and the capital labour substitution effect make long-term impact on employment rather indefinite and did not allow for a safe conclusion.

2.3.3 Cost Savings

In this section we present our findings on the externalities of broadband expressed as cost-savings to the end-user and to businesses, by incorporating e-government services. Table VII presents all the variables calculated in our analysis. As the table shows, the cost savings calculated were significant for every country, of the order of million Euros.

Figure 5 displays the current as well as the expected savings if countries reach the levels of e-services utilization set for 2015 by Europe's digital agenda. Further incorporation of broadband-facilitated services is shown to be highly beneficial for end-users, firms and public administration finances. In our analysis we do not take into account all transactions conducted through e-services, and we do not include the savings originating by travel or post fees reduction. Thus, we consider our estimations to be conservative and the actual savings to be greater.

Table VII. Cost Savings due to e-Government Services.

Country	Num. of transactions (thous.)	Num. of online transactions (thous.)	Time of transactions (yrs.)	Total savings (mill. euros)	Potential savings (mill. euros)
Austria	-	-	-	-	-
Bulgaria	5263	1402	742.48	5.5983	10.507
FYROM	1450	159	84.4945	2.5858	11.754
Greece	7965	820	434.452	8.878	43
Montenegro	444	52	27.5424	0.02076	0.08874
Slovenia	1435	775	410.585	9.0518	(Already reached 50% of e-government usage)
Italy	42122	4212	2230.4	62.694	313.470

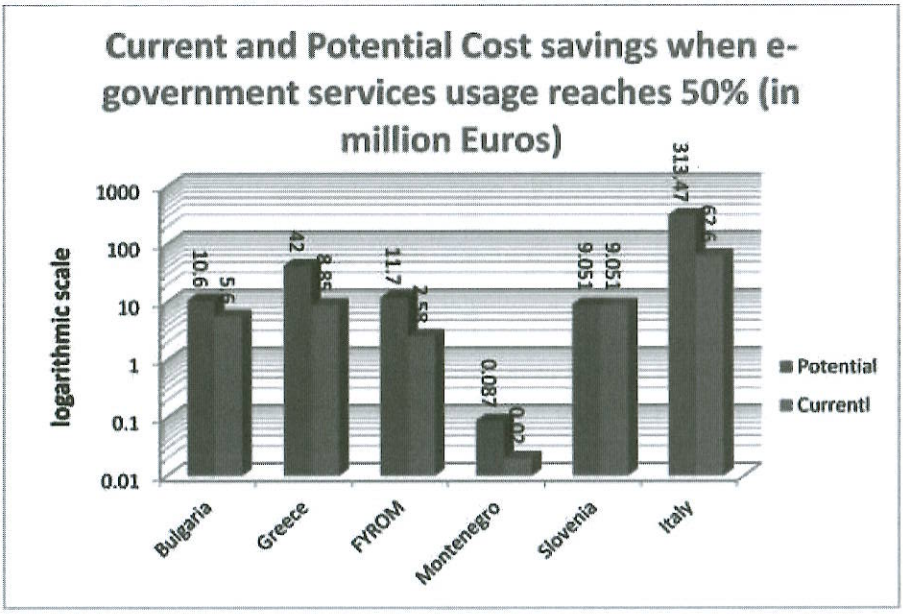

Figure 5. Cost savings through e-government services if broadband penetration reaches 50% (in million Euros)

The theoretical connection between total savings per year and e-services usage yields to Figure 6. While there are deviations between the countries, the amounts relative to their GDP are significant for all.

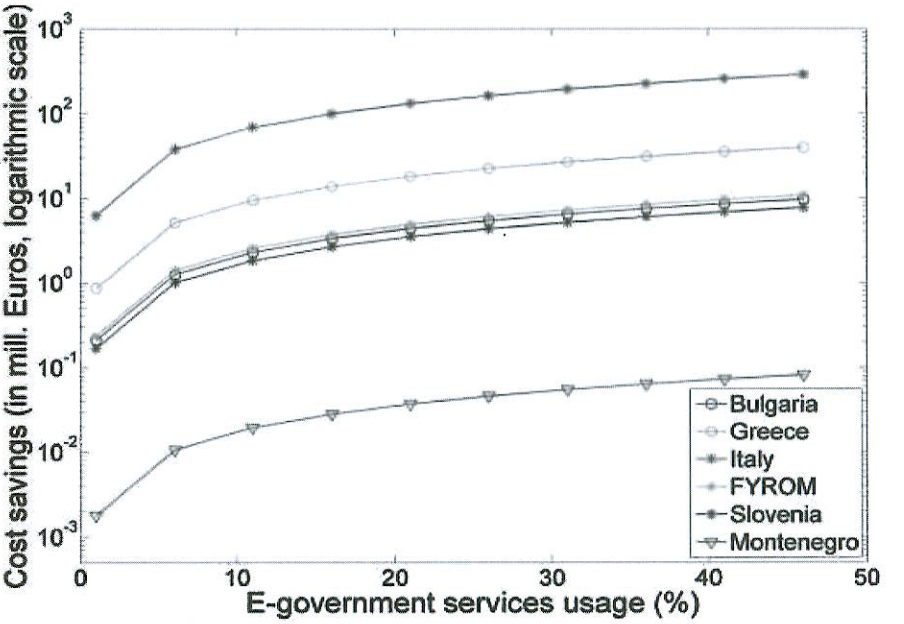

Figure 6. Expected total savings per year vs. the e-government services usage

2.4 Conclusions

This chapter examined the impact and effectiveness of virtual accessibility public infrastructures and services in selected SEE areas on employment and growth. First we presented the econometric analysis that led us to specific conclusions regarding the impact of broadband on growth and employment. While the estimation is considered conservative, the benefits of broadband provision have been found significant. When the amount of data permits reliable analysis, our conclusions suggest that broadband affects positively the economy growth of a country. Besides the adequate time needed to fully reveal its impact and the complex dependencies that broadband exhibits in the economy, the positive stimulation of broadband on growth of SEE areas is evident, and it should be considered as an attractive candidate for boosting economic development.

Specifically, growth was found to benefit greatly from increased broadband provision, showcasing GDP increase that ranged from 0.2% to 2% (depending on the country) with increase in broadband penetration by 10%.

As far as employment is concerned, findings were inconclusive as expected. As expected the difficulties of measuring the impact on employment are substantial. The amount of available data was not sufficient for some countries, thus calculations were unsafe or not conducted at all. Overall, employment is expected to rise initially due to manpower required to support the construction and maintenance of broadband needed infrastructures (i.e. technicians, engineers, architects, electronic manufacturers etc.). The subsequent effects, though, are inconclusive depending on the production substitution effect and tendency of its country to new services and practices to compensate for possible loss of jobs.

Finally, cost reduction through e-government services to companies, end-users and the state were found quite considerable and beneficial, especially for countries exhibiting high broadband penetration rate. Projecting the findings in 2015 where e-services are expected to increase significantly according to the European directives, the corresponding benefits were found extremely large.

In times where the economy of many countries is in recession, broadband related investments prove to be an overall significant way of boosting the economy providing both economy stimulation in industries, and significant cost savings. Thus, policies that pursuit or facilitate the increase of virtual infrastructure and broadband provision should be considered a strong candidate solution by authorities for a positive impact on the economy.

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2.6 Abbreviations

FTTH	Fiber to the Home
GDP	Gross Domestic Product
ICT	Information and Communication Technologies
ITU	International Telecommunication Union
OECD	Organisation for Economic Co-operation and Development
SEE	South East Europe
SIVA project	South East Europe improved virtual accessibility through joint initiatives facilitating the rollout of broadband networks

3) INFRASTRUCTURES SHARING

Produced by TECLA
Co-authors: Bouras Christos, Kokkinos Vasileios, Diles Georgios

The main purpose of this chapter is to present basic facts about infrastructure sharing agreements that aim at the reduction of broadband deployment cost, complying at the same time with the general European competition rules. Special attention is given to agreements that aim specifically at the reduction of the digital divide i.e. they regard joint investments made for the promotion of broadband in not served or underserved areas. The analysis takes place first through the establishment of the rationale and the existing framework regarding sharing network agreements of broadband in the wider area of Europe. It concludes with the presentation of specific cases of agreements in the area of the Consortium and the main findings from their comparison. The presentation of the cases focuses on specific areas of interest, facilitating thus their comparison.

3.1 The rationale for infrastructure sharing

Similar to all utility networks, the deployment of broadband networks is by default an extremely capital intensive initiative with a high sunk cost, representing thus a high risk investment. This inevitably increases the likelihood (at least initially) that there will only be one or two telecommunication operators, covering just the main urban markets of the country involved, where the demand rationalizes the cost of the investment.

A critical aspect of promoting wider broadband use is ensuring that the infrastructure is affordable. Lower cost of broadband infrastructure leads to affordable pricing and subsequent take-up of services. Affordable pricing in turn encourages the "critical mass" of users, as well as the services and applications that they might use. Due to the nature of broadband though, the deployment of infrastructure is both encouraged and at the same time prohibited by the existing network externalities; without the creation of broadband networks there will be no "critical mass" of users and without the users, the economic and social benefits of broadband will not be delivered. Hence, market by itself often fails to ensure the affordability of broadband infrastructure deployment in certain territories. These territories run the risk of enlarging the so called "digital divide" and become second class markets in the global broadband and competitiveness order.

One way of diminishing the cost of broadband roll out is the enhancement of effective market competition. While competition at the international level has often driven down the price of bandwidth, national bandwidth prices (especially in less developed countries) are still set by one or two providers and as a result they often remain high (Cohen and Southwood, 2008). Policy makers and regulators are constantly seeking to create the right incentives and conditions for competition in ICT markets. The sharing of broadband infrastructure by telecommunication operators is one such option attracting increasingly greater policy attention.

Main Issues addressed by infrastructure sharing

As already mentioned, one of the most important policy concerns underlying the growing regulatory interest in sharing is the promotion of rapid and efficient network deployment. In other words, sharing infrastructure is one strategy for achieving national broadband infrastructure more quickly than through simply letting the market take its course.

Although the modes of sharing differ and although each network raises particular policy concerns, broadly speaking, sharing facilitates a rapid, less costly and less disruptive deployment of networks, whether the network is mobile, fixed broadband, or Next Generation Access (NGA)[1]. In general, sharing helps to address the following obstacles to efficient and timely network deployment:

- The high costs of network roll-out. These mainly concern the first stages of network deployment and are particularly connected to the passive elements of broadband infrastructure (e.g. civil works). In this case the notion of sharing is quite straightforward i.e. the cost of development will be less if divided among two or more operators.

- Poor investment incentives in not served or under-served areas. Following the first argument, the essence of this argument is that two or more operators sharing (and paying for access to) a common infrastructure will help finance a wider roll-out, whereas traffic from a single operator would not make the same level of routes sustainable.

- Restricted access to "bottleneck facilities"[1] . This is the case where, a single dominant operator can be seen as the controller of key infrastructure elements (i.e. the "bottleneck" or "essential" facilities). In this case, the operator usually questions the commercial rationale for providing to others access to his infrastructure and has an unfair advantage over its competitors at all levels, but particularly in downstream markets due to his strong ownership. Most commonly, the development of broadband infrastructure is in this case is prohibited by the price advantages that a vertically-integrated operator can give himself unless otherwise constrained.

[1] http://www.ictregulationtoolkit.org/

3.2 Models of sharing broadband infrastructure

There is a number of ways that infrastructure sharing takes place and thus a number of aspects under which to investigate the various sharing arrangements, as well as the more important policy issues concerned. The main parameters that first come to mind when it comes to broadband infrastructure sharing are usually the type and the technical elements of the network. Nevertheless, the actual mode of infrastructure sharing depends on a number of other decisions and factors like e.g. the access market (wholesale, retail), the existing regulation, the number and market share of players, the ownership of the shared infrastructure, the degree and the economic aspects of sharing etc. A combination of all these factors forms in the end the business model of the network sharing agreement.

In what follows, we briefly describe the main types, layers and technical elements of broadband networks, so that the potential of network sharing can be better understood. In addition, we mention some examples of network sharing business models.

3.2.1 Type of network

As far as the type of infrastructure is concerned, the most obvious distinction is between mobile and fixed broadband, a distinction based on the type of technology used. A series of other distinctions can be made, the most prominent referring to the horizontal extension of the network, like:

- Backbone networks: national or international networks of high capacity
- Backhaul networks: regional and intermediate networks between backbone and access networks
- Access networks: the final segment of the network that connects to end-user premises e.g. Next Generation Access Networks (NGANs).

It is worth mentioning that in many developing countries, the network in question is the mobile network, which is increasingly becoming the dominant form of infrastructure in these countries, as well as the backbone for the provision of universal access. In more developed and industrialized countries, the emphasis is on national broadband access networks and in particular NGANs.

3.2.2 Network layers and technical elements

Another distinction of broadband infrastructure has to do with its vertical integration and its

formation in layers. Again, there are admittedly many distinctions regarding the technical elements of the layers of broadband infrastructure. Nonetheless, one seems to be the most clear: between passive and active infrastructure elements. In particular:

- Passive infrastructure includes all the civil engineering and non-electronic elements of infrastructure, such as physical sites, dark fibre, poles and ducts (and also power supplies).

- Active infrastructure covers all the electronic telecommunication elements of infrastructure like lit fibre , access node switches, and broadband remote access servers.

It should be mentioned that, once the passive and active layers are in place, services come into play. This is the layer where the internet connectivity is packaged as a service for end users, consumers and businesses.

Upon the type of the end customer, another important distinction is made, which also concerns the different layers of the network: the distinction between the wholesale and the retail broadband access market. In general, there is not a unique definition of the terms. According to the 2007 Recommendation of the European Commission, the wholesale broadband access market "...comprises non-physical or virtual network access including 'bit-stream' access at a fixed location..." (European Commission, 2007).

A rather more comprehensive way to see these concepts (especially for the purposes of this study) is to consider that each network layer has a corresponding function: (a) the network owner is in charge of the first layer i.e. the passive infrastructure of the network (although he will probably outsource its construction to a third party), (b) the wholesale provider owns the active equipment, while (c) the retail services are provided by the internet service provider (ISP).

3.2.3 Examples of network sharing business models

The business models that are actually formed in the context of network sharing agreements are numerous, rather complicated and vary significantly. In what follows, we briefly mention some examples of network sharing models, based on the prevailing literature.

The Fibre-to-the-Home Council identifies four network business models used in the FTTH market that stimulate competition at different network layers. It should be mentioned that network sharing does not occur in the first one, nevertheless it is mentioned in order to have a more accurate view of all the proposed business models (Fibre to the Home Council Europe, 2010):

Vertically integrated model

The vertically integrated model means that one operator controls all the layers of the network, and consequently, if a second operator wishes to also offer broadband and telephony services in the same area, he will have to build his own infrastructure, operate it and market it directly to the end-users. This is a clear form of infrastructural competition.

Passive sharing model

While this model can be considered a form of infrastructural competition, it leverages a single passive infrastructure, which is built and maintained by one owner. The active and services layers are owned by a different organization. In this model a second service provider may share the same passive infrastructure with the first service provider, but will still have to invest in active network equipment and operations as well as the services and go-to-market activities.

Active sharing model

In the active sharing model a single organization owns the passive infrastructure and operates the active network. This vertical infrastructure owner wholesales broadband access to the various retail service providers who will then compete against each other for customers. Only the active elements of the network are shared in this model. The regulatory framework associated with this model regulates active wholesale specifically, and seeks to encourage service competition.

Fully separated model

Full separation, as was already mentioned above, partitions the ownership of the different layers. Each layer is owned by a different player, with the infrastructure owner generating income by providing passive infrastructure access to the network operator, who in turn wholesales broadband access to retail service providers. This model stimulates competition at the services level and goes hand in hand with regulatory requirements for passive and active wholesaling.

Other business models of broadband sharing infrastructure that have become popular in the telecom industry are the following (KPMG, 2011 and Bhardwj, 2013):

Inter-operator tower sharing model

Operators generally use bilateral arrangements to execute inter-operator sharing of passive infrastructure. Typically, these bilateral agreements are on an "in-kind" basis, with no payments

made between the parties. The two parties agree to install Base Transceiver Stations (BTSs) on each other's towers. Inter-operator sharing is an operational method adopted to cut down on network costs. The economic benefits created for the involving parties mainly stem from (a) the reduction of network deployment costs, (b) the reduction of the required time for roll out, and (c) the potential for generating additional income through rentals earned from other operators using the towers (depending on the structure of the contract). It should be mentioned that, while these types of deals tend to benefit operators who have already established networks, they do not typically help new entrants.

Third-party tower companies model

According to this model, independent companies assume responsibility for tower deployment and maintenance, entering agreements with operators that allow them to install their BTSs on the towers. In this model, the ownership of passive infrastructure equipment lies with the tower company. The decision to outsource tower operations to third-party tower companies typically involves a strategic shift to focus on service innovation and improving customer experiences. This aspect becomes critical in highly competitive telecom markets. A separate company focusing on the passive infrastructure business results in savings through several other means. Third-party tower companies can be one of two types: (a) Joint ventures between operators and (b) third-party vendor tower companies.

It should be mentioned that in general, network sharing may include a number of parties. While there may be important commercial and practical hurdles to overcome, there are no fundamental reasons why multiple operators cannot share networks. Sharing agreements may concern individual sites, a number of sites or particular regions. Especially, passive sharing models do not require a fully merged network architecture and thus there are cases of unilateral, bilateral (mutual access) or multilateral agreements.

Mobile Virtual Network Operator (MVNO) sharing model

A more complex form of sharing is the mobile virtual network operator (MVNO). This model involves the sharing of active infrastructure that can be realized at different degrees. Mobile Virtual Network Operators (MVNOs) are operators or companies that do not own a licensed spectrum nor their own networking infrastructure . Instead MVNOs usually rely to a greater or lesser extent on components provided by the incumbent. In general, an MVNO enters into a business agreement with a mobile network operator to obtain bulk access to network services at wholesale rates, and then sets retail prices independently. An MVNO may use its own customer service, billing support systems, marketing and sales personnel or it may employ the services of a mobile virtual network enabler (MVNE).

MVNOs first appeared in Denmark, Hong Kong, Finland and the UK and today exist in over 50

countries, including most of Europe, United States, Canada, Australia and parts of Asia. It is estimated that they account for approximately 10% of all mobile phone subscribers around the world[2].

3.3 Infrastructure sharing: policy and regulation

Infrastructure sharing is becoming an issue of interest both to the ICT industry and operators as well as to the policy regulators. More developed economies already have numerous models of infrastructure sharing like the ones mentioned above. The creation of such open access models requires that the telecommunication operators fully perceive their value as a revenue generating opportunity. Although for new entrants this is quite obvious, for the incumbent operators (usually investor or state owned monopoly enterprises) this is not usually the case. Hence, effective and enabling regulation and policy are critical in order to facilitate the creation of network sharing arrangements between operators.

The policy issues related to infrastructure sharing are complex, as sharing offers both the possibility of enhancing and hindering market competition. On the one hand, sharing policies can help to increase competition in the ICT sector, through the reduction of deployment and operating cost. On the other hand, too much sharing undermines the incentives for investment in infrastructure-based competition. A very permissive sharing regime makes it possible for operators to become active without investing in their own infrastructure. If most operators rely on the same underlying infrastructure providers, it is likely that there will be little ultimate differentiation in their services. The benefits of competition like lower prices and consumer choices are reduced as a result.

Ultimately, there is an inevitable tension between the equally important goals of reducing barriers to market entry and stimulating investment in infrastructure. Both of these goals are relevant to maintaining healthy competition in the ICT sector. Achieving the appropriate balance between these goals is a delicate matter for policy makers and regulators.

Over the last decade, the telecommunication sector worldwide witnessed a wave of reforms that resulted (among others) in the establishment of a national regulation authority in most of the countries, the introduction of competition in some or all service segments and at least the partial privatization of the incumbent operators. In these reforms, the policy makers face the challenging task of regulating a market that is changing very rapidly, without stifling any type of innovation, and without improperly disadvantaging any competitor.

The result of this wave of reforms has indeed been an increased take-up of broadband services.

[2] http://www.ictregulationtoolkit.org/2.6.6

However, despite the rather impressive progress, much of the population still remains without access to broadband services. Regulators around the world are considering infrastructure sharing as a tool to further promote infrastructure deployment, especially considering broadband access networks.

European regulation for infrastructure sharing

The European Union has long realized the need for regulatory measures promoting competition in the broadband market. In its effort to support and facilitate broadband roll-out throughout European regions, EU has adopted a series of complementary measures, some of which are specifically designed to ensure the appropriate aforementioned balance between investments and market competition. The most prominent are mentioned below.

3.3.1 EU Regulatory framework for electronic communications

The opening-up of the telecommunications market to competition has acted as a catalyst on a sector previously reserved for oligopolies. To keep up with these changes, Europe's decision-making bodies have long adopted legislation in tune with technological progress and market requirements. These developments have given rise to the adoption of the regulatory framework on electronic communications, the main aim of which is to strengthen competition by making market entry easier and by stimulating investment in the sector.

The 2002/21/EC Directive on a common regulatory framework for electronic communications networks and services (i.e. the "Framework Directive") forms part of the "Telecommunications Package" designed to recast the regulatory framework for telecommunications in order to make the electronic communications sector more competitive (European Parliament and Council, 2002).

The main objective of this Directive is to establish a harmonized framework for the regulation of electronic communications networks and services. It also includes certain aspects of terminal equipment to facilitate access for disabled users. Among a number of other horizontal provisions, the Directive provides general definitions and provisions about a series of competition issues on the operation of all electronic networks (including broadband networks), as well as rules regarding the role of the National Regulatory Authorities (NRAs) and the concept of Significant Market Power operators. The most important provisions are more analytically presented in the Annex of the report.

The adoption of the EU electronic communications reform package in November 2009 further enhanced the European electronic communications market by revising rules to ensure more effective competition and better rights for consumers.

More specifically, the Article 12 of the directive 2009/140/EC (European Parliament and Council, 2009) determines the legal framework and the provisions for the mandated access to passive infrastructures and the sharing of network facilities. The directive defines explicitly that "where an undertaking providing electronic telecommunications networks has the right under national legislation to install facilities on, over or under public or private property, national regulatory authorities shall, taking full account of the principal of proportionality, be able to impose the sharing of such facilities and infrastructures".

3.3.2 European Commission Recommendation on regulated access to Next Generation Access (NGA)

This Commission Recommendation 2010/572/EU (European Commission, 2010) was adopted in the framework of Europe's Digital Agenda (EDA). Its target is to significantly contribute towards the EDA's ultimate goal of allowing every European to access fast broadband by 2013 and very fast broadband by 2020. Therefore, the Recommendation defines a common regulatory approach regarding access to new very fast broadband networks using optical fibre, offering a balance between encouraging investment and maintaining competition.

More particularly, the Recommendation aims at promoting the transition to Next Generation Access Networks (NGANs), through the establishment of a common approach for the regulation of access to NGANs. This approach is formed on the basis of a prior market analysis procedure pursuant to the previous EC Directives 2002/19/EC and 2002/21/EC on electronic communication networks.

The Recommendation in general strengthens and orientates the role of the National Regulatory Authorities (NRAs) in the transition process towards NGANs. More particularly, the Recommendation foresees that NRAs should first of all ensure that operators designated with Significant Market Power (SMP) provide all necessary information for designing regulatory remedies. In addition, where divergences in the conditions of competition are stable and substantial, NRAs may define sub-national geographic markets in accordance with Recommendation 2007/879/EC. Where divergences in conditions of competition cannot be identified adequately, NRAs should carry out monitoring to determine whether deployment of NGA networks might nevertheless justify the implementation of differentiated remedies.

The Recommendation foresees specific remedies for preserving the competition in the cases of SMP operators both at the wholesale physical infrastructure layer of the network (named as Market 4) and the wholesale broadband access market (names as Market 5). In addition, there are certain provisions regarding the migration agreements between SMP and other operators. These are briefly described below.

Access to wholesale physical network infrastructure (Market 4)

Where the market includes operators in a dominant position (SMP), NRAs should put in place remedies which must take into account:

- Access to civil engineering infrastructure of the SMP operator, which should be mandated at cost-oriented prices
- Access to the terminating segment in the case of FTTH (Fibre to the Home) deployment which must include access to the wiring inside buildings and, if applicable, horizontal wiring up to the first distribution point
- Unbundled access to the local fibre loop in the case of FTTH deployment which should be accompanied by appropriate measures for co-location and backhaul. In addition, this access should take place at the most appropriate point in the network, which is normally the Metropolitan Point of Presence (MPoP)
- Obligatory unbundled access to the copper sub-loop in the case of FTTN (Fibre to the Neighborhood) deployment which should be supplemented by backhaul measures and ancillary remedies.

Wholesale broadband access (Market 5)

Where SMP is found on Market 5, wholesale broadband access remedies should be maintained or amended for existing services and their chain substitutes. On this market, NRAs are encouraged to mandate the provision of different wholesale products that reflect the technical capabilities inherent in the NGA infrastructure in order to foster competition between operators.

Migration agreements

The obligations concerning SMP should be maintained, except where migration agreements are concluded between the SMP operator and the operators enjoying access to the SMP operator's network. If agreement is not reached, the SMP operator must warn the other operators at least five years before any de-commissioning of points of interconnection takes place.

Concerning the migration from copper to fiber-based networks, NRAs must put in place a transparent framework. They must ensure that undertakings enjoying access to the SMP operator's network receive all necessary information in order to adjust their networks and network plans.

3.4 Comparisons and main findings

This section presents the main findings produced by the comparison of related case studies in SEE countries as collected by the respective partners. These findings were produced by the comparison of the network sharing agreements focusing of the mains areas of interest and their parameters. In particular, the areas of comparison involve the profile of the participants in the agreements, the network elements shared, the geographic scope of the sharing agreements and the way the agreement takes place. Some general conclusions concerning the ultimate target and aim of these agreements are also presented.

Who shares with whom

Many of the presented cases involve agreements between former state owned telecommunication incumbents (monopolies of the past that still hold a dominant market share in the national markets) and other smaller telecommunication operators that do not own their own infrastructure. Usually, the incumbents are obliged to promote and form such sharing arrangements by the national regulatory telecommunications commissions for reasons of fair competition and thus provide access to other operators at regulated wholesale prices. The regulatory commissions are obliged to foresee and ultimately take such measures under the European legislative framework on competition in the telecommunication sector. Nevertheless, even when the agreements do not involve the incumbent or an SMP operator and are not the outcome of legal obligations, they are still made between not equal operators i.e. one has usually a larger share or a stronger position in the market than the other one. These arrangements seek to combine different strengths and characteristics of the operators (e.g. Vodafone and HOL case of Greece).

What to share

Most of the agreements and especially those concerning the sharing of the incumbent's infrastructure, involve the last section of broadband networks i.e. the access networks. As far as the technical elements of the infrastructure are concerned, there does not seem to be a clear trend. The agreements of the countries under examination usually involve the sharing of both passive and active elements of the network. Most common is the sharing of broadband infrastructure that concerns mobile technology.

Where to share

The geographic scope of the presented agreements varies, but in most cases it involves specific territories of the countries under examination. This is only logical, as usually the aim of these arrangements is the broadband coverage of underserved or not served areas of the country.

How to share

The most common way of forming this kind of partnerships is through the creation of bilateral agreements between the interesting parts. This usually involves the contractualization of the agreement where all the terms and conditions of the sharing are presented analytically. Only in one of all the presented cases, the sharing took place through the establishment of a new company (i.e. the case of Vodafone – Wind in Greece). In many cases the sharing does not involve a pricing policy, but simply the mutual exchange of infrastructure between the operators.

The ultimate goal of all the described arrangements is the reduction of cost in the deployment of networks and/or the provision of broadband services. Apart from the cases that the sharing is actually imposed to the SMP operator as a legal obligation for reasons of fair competition, the cost savings for the participants are mutual. These arrangements constitute of cost effective ways of collaboration for the expansion of broadband services for all the interesting parties. The benefit is more obvious and important when the expansion of broadband services concerns underserved or not served territories.

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3.6 Abbreviations

BTS	Base Transceiver Station
EDA	Europe's Digital Agenda
FTTH	Fibre to the Home
FTTN	Fibre to the Neighborhood
ISP	internet service provider
MPoP	Metropolitan Point of Presence
MVNO	Mobile Virtual Network Operator
MVNE	mobile virtual network enabler
NGA	Next Generation Access
NRA	National Regulatory Authorities
SMP	Significant Market Power

4) THE POLICY STATUS AND RECOMMENDATIONS

Produced by TUV
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It has become obvious by the previous chapters that broadband development has become an active topic of interest in the national and international policy and decision making field, and it is increasingly deemed an important determinant of economic growth and social cohesion.

The strong impact of broadband networks in development is obvious both in the national and international level (OECD 2008). As we have seen, on the one hand direct effects of broadband on economic growth relate to the positive influence in terms of business activities and employment investments in broadband technologies and in the rolling out of infrastructures. On the other hand, broadband has a number of indirect effects through a variety of channels, such as innovation production, technology and productivity enhancement, competition increase and upgraded public sector services.

While there is no dispute about the increasing usage of the World Wide Web in both the developed and developing countries, the quality of such usage and its potential impact on the economy and society as a whole are clearly determined by the degree and nature of broadband connections. On average, while broadband adoption is increasing globally, a significant variance is observed both among countries and within each country. At an international level, countries still show non-convergent paths, while even within the most developed countries a persistent digital divide is present between urban and rural areas, as well as between wealthier and poorer regions (Florence School of Regulation, 2011).
Findings of Chapter 1 show the heterogeneous diffusion of broadband connections among territories stems mainly from the fact that market mechanisms fail to address adequately the low population density and rural and remote areas. The observed inadequacies in the communication infrastructure and accessibility to services among countries, territories or even individuals hamper significantly economic development, competitiveness as well as social cohesion. The existence of these inequalities sets apart from economic motivations a series of social justifications for public interventions aiming at the correction of this market failure, such as social inclusion and provision of equal access to services for all citizens.

While regulations that accommodate private initiatives to reduce costs have helped tremendously (such as sharing infrastructure regulations discussed in the previous chapter),

the participation of the public sector in policy making must be more strong and active. Considering all the above, it comes as no surprise that the increase of broadband development and the simultaneous reduction of observed disparities have become important policy aims, declared and shared by many national and transnational political institutions, regulatory bodies and independent agencies. Currently, the worldwide and European policy debate on these issues is so intense that an extensive policy making is taking place regarding the promotion of broadband connectivity. The main characteristic of this debate is the gradual shift from a "market approach" to a "mixed approach" of interventions, in which plenty of room is left to direct public policies in order to reduce the digital gap and to encourage broadband investments via the creation of market dynamics in areas outside the competitive environment (Florence School of Regulation, 2011).

More specifically, European Commission has drafted the Digital Agenda for Europe (DAE) as one of its flagship initiatives for Europe 2020, explicitly aiming to provide all citizens with the capability to access fast internet services by 2013 and ultra-fast internet by 2020. In order to achieve this goal, member states have been called to create national broadband policies and set targets for national broadband usage.

4.1 Evaluation of broadband and NGA policies

The need and impact of public intervention for broadband diffusion

The role of public policy in the development of electronic communications networks has evolved over the last decades, influenced by the prevailing economic school of thought and by the common perception of the role of the public sector at each period of time. In the mid-80s, the electronic communications sector in Europe was greatly affected by the general process of liberalization and privatization in many industries, ending in opening the prospect of a sharp reduction in the role of the state (Belloc and Nicita 2011a and 2011b). In this context, direct public intervention was ruled out and the role of public decision-makers was limited to regulation, designed by independent regulatory bodies supervising firms with significant market power, with the aim of enhancing competition and citizens' interests, as well as of encouraging efficient investment in infrastructure and promoting innovation (Parcu et al. 2011).

The view that public intervention affects investment only indirectly, was dominant until the end of the last decade, but is now evolving again (Cave and Ian, 2010). The high costs implied by the construction of broadband lines (and NGA networks in particular) and the low propensity of the market to ensure that these investments are actually made (market failures) especially in rural and remote areas, have placed again the issues of planning and financing of electronic communications networks (at least in part) in the hands of public decision-makers (OECD, 2008).

Several elements of the market environment, both on the supply and demand side, suggest that carrying out the necessary investments could take a long time and a lot of money. On the supply side, uncertainty on the timing of recovery of investments is coupled to a declining profitability of investments in fixed telephony networks that are still in use for providing broadband services. Moreover, ongoing changes in the electronic communications markets' value chain (i.e. the ever increasing relevance of application and the Over-the-Top Content providers) create the scope for an adjustment of the industry's traditional business models. On the demand side, there is a significant degree of uncertainty about the willingness of consumers, already using the existing electronic communications networks, to pay for an upgrade of the connection. All the above factors make the business case for private investment rather uncertain, and the state appears to be endowed with a new role in the planning and financing of electronic communications networks (Florence School of Regulation, 2011).

To all the above, it must be added that the financing of electronic communications networks is not perceived anymore as a sector-specific intervention, but as a cross-industry policy necessary to promote the general economic and social welfare. Indeed, accessibility of advanced communications tools to citizens and enterprises is considered an essential precondition for the creation of the "information society" as defined by EU standards and for the implementation of social inclusion policies. The participation of citizens in the society has become inseparable from the notions of development and competitiveness of the countries. In other words, the availability of advanced electronic communications infrastructure is increasingly perceived as one of the key factors to promote the development and to avoid the underdevelopment of territories.

Thus, the debate is not currently so much focused on whether public players should intervene, but rather on how their intervention should be articulated. That is, the relevant issues concern the most appropriate means to design regulatory and policy strategies to promote broadband connections and to facilitate market development, as well as to participate in investments schemes with the private sector through public-private partnerships in order to cover market failures. Below we present the main characteristics, advantages and disadvantages of PPP and afterwards the EU regulatory measures planned or in effect, and their adoption by SIVA consortium countries.

PPP

Public Private Partnerships (PPPs) are a valuable tool for the provision of quality services to citizens. Via the implementation of PPPs, the public sector is making use of contemporary finance tools to provide ICT services to citizens enhancing the existing framework of public procurement. The term PPP refers to a long-term, contractually regulated cooperation between the public and private sector for the efficient fulfilment of public tasks in combining the necessary resources (e.g. knowhow, operational funds, capital, personnel) of the partners and

distributing existing project risks appropriately according to the risk management competence of the project partners which is carried out by using the conditions laid down by the law.

There are four main characteristics of PPP:

- efficiency gained through appropriate sharing of risks and responsibilities;
- the public sector retains mainly sovereign tasks and the private bears those for implementation;
- lifecycle and private investment as crucial elements of PPP's incentive structures;
- long term contractual relationship;
- and innovation, in particular through output specification, service levels and payment mechanisms, as a new way of describing the services to be supplied.

One of the major objectives of PPP is to transfer tasks and responsibility for the provision of infrastructure to the private sector, in order to gain efficiency, cost reliability and financial security. The traditional procurement of public infrastructure and its related services has given way to the private sector assuming responsibility for design, construction, operation, management, maintenance and finance, with the public sector as the customer or, sometimes, as the direct user, paying for the provision of a service. The public sector, nevertheless, should not lose its sovereign task such as assessing and determining infrastructure needs, monitoring and supervising of an efficient and competitive procurement system, and assuring all required environmental and safety standards in the service delivery.

The principal aim of PPP is to involve the private sector in the provision of public services, shifting the role of the public sector from the owner and provider to purchaser and guardian of the interests of the public. It is driven by the belief that the public sector should focus on its core functions, leaving the private sector to perform those functions which it can often do more cost effectively and efficiently. One of the key political drivers behind the PPP is the desire to improve the nation's infrastructure and supporting public services without placing undue strain on scarce public funds and without having to increase taxation.

A public private partnership is a long-term contractual partner relationship between the public and the private sector. It may include financing, design, construction, operation and/or maintenance of infrastructure and/or provision of services by the private sector, which are usually procured and provided by the public sector. The PPP model yields benefits for both sides, provided that there is an effective combination of goals of the public and the private sector. It is important to recognise the circumstances where a PPP might be the best method for the delivery of a particular service or the construction of infrastructure in comparison to other traditional public procurement methods.

Public private partnerships open up opportunities for private investments which can result in the realisation of projects which would otherwise, based on the classic (budgetary) funding, not be possible or which would require much longer periods of time for implementation, which is often not acceptable where certain public services or their adequate level should be ensured promptly.

Preparation and implementation of PPPs is a lengthy and expensive process. Hence, the PPP model should be used only if the distribution of risk provides the public sector with lower aggregate costs over the entire agreed term of the project (greater value for money), or access to knowledge, skills and the like, which would otherwise not be available and which contribute significantly to the level of public services rendered. In order to fulfil the above criteria a series of preliminary studies (such as market research, investigative work to select locations, feasibility studies, sustainability studies, etc.) and the criteria for justifying the use of the PPP model should be drawn up.

Advantages of PPP

The advantages of PPP are considered as follows (Alfen, 2009):

- to remove the responsibility of funding the investment from the government's balance sheet;
- to introduce competition;
- to adopt managerial practices and experience of the private sector;
- to restructure public sector service by embracing private sector capital and practices; and
- to achieve greater efficiency than traditional methods of providing public services.

Furthermore, private partners' intervention in financing and management of public projects enables the pursuing further aims such as:

a) upgrading and fine-tuning of project evaluation methodologies via whole life costing techniques (i.e. infrastructure whole lifecycle) which enable optimising capital account expenses;

b) rigorous estimate of benefits that public operators can attain via partnership solutions alternative to traditional public financing (i.e. Value for Money); and

c) possibility to transfer part of project risks to private sectors compliantly with transparent, proportionate and ad-hoc patterns.

In PPP projects cooperation with the private sector is able to offer a number of advantages,

including:

- Efficiency and higher quality process of construction and operation of the infrastructure and provision of required services by entities of the private sector, compared with the public sector entities; usually the projected costs are not exceeded and the given deadlines are met;

- Solution of limited disposable sources of the public sector, where the capital power of the private sector entities can be sensibly used for implementation of the projects whose execution would not be possible without their partnership;
- Acceleration of infrastructure provision - PPPs often allow the public sector to translate upfront capital expenditure into a flow of ongoing service payments. This enables projects to proceed when the availability of public capital may be constrained (either by public spending caps or annual budgeting cycles), thus bringing forward much needed investment;
- Strengthening public administration resulting from entrance of new purposively and economically thinking partners into provision of public services and meeting public interests and needs, shortening the process of decision-making and diminishing the rate of bureaucracy;
- Faster implementation - the allocation of design and construction responsibility to the private sector, combined with payments linked to the availability of a service, provides significant incentives for the private sector to deliver capital projects within shorter construction timeframes;
- Reduced whole life costs - PPP projects which require operational and maintenance service provision provide the private sector with strong incentives to minimize costs over the whole life of a project, something that is inherently difficult to achieve within the constraints of traditional public sector budgeting;
- Better risk allocation - a core principle of any PPP is the allocation of risk to the party best able to manage it at least cost. The aim is to optimize rather than maximize risk transfer, to ensure that best value is achieved;
- Better incentives to perform - the allocation of project risk should incentivize a private sector contractor to improve its management and performance on any given project. Under most PPP projects, full payment to the private sector contractor will only occur if the required service standards are being met on an ongoing basis;
- Improved quality of service - international experience suggests that the quality of service achieved under a PPP is often better than that achieved by traditional procurement. This may reflect the better integration of services with supporting assets, improved economies of scale, the introduction of innovation in service delivery, or the performance incentives and penalties typically included within a PPP contract;
- Generation of additional revenues - the private sector may be able to generate

additional revenues from third parties, thereby reducing the cost of any public sector subvention required. Additional revenue may be generated through the use of spare capacity or the disposal of surplus assets;

- Enhanced public management - by transferring responsibility for providing public services government officials will act as regulators and will focus upon service planning and performance monitoring instead of the management of the day to day delivery of public services. In addition, by exposing public services to competition, PPPs enable the cost of public services to be benchmarked against market standards to ensure that the very best value for money is achieved;
- More benefits and satisfaction for the citizens resulting from utilization of the know-how of private companies in applicable operational areas and from their distinct motivation formed by the possibility of long-term income while meeting all contractual terms and conditions concerning the quality of the provided services, while the required standard is continuously evaluated and controlled by the public sector.

Disadvantages of PPP

While PPP offers plenty of advantages, there are also some disadvantages related to PPP projects:

- slow preparation of individual PPP Projects, which may take up to two years if the preparation of the project is to be of high standard;
- absence of preliminary verifications on PPP actual convenience in terms of optimisation of Public Administration costs;
- Public Administrations' inadequate capacity to report and interact with the private partner, both in identifying respective contractual obligations and monitoring contract execution;
- PPP Projects prefer the economic aspects of the project to the social, environmental or other aspects;
- excessive trust in PPP solving capacity as an alternative to poor availability of public resources;
- considerably negative financial impacts in case the partnership has to be cancelled;
- possible transfer of risks from the private sector to the public sector, e.g. risk of bankruptcy.

In general, the most common misunderstanding about PPP is that it can be used for the projects that for economic reasons cannot be financed solely with public funding. The contrary is true: PPPs require higher returns on investment, as private investors ask for returns that are measurable in direct financial results, while some pure public investments are never financially repaid or they have positive effects on a wider economic and social tissue, which cannot be

attributed directly to a single beneficiary.

PPP models

The European PPP Expertise Centre (EPEC) is a joint initiative involving the European Investment Bank (EIB), the European Commission, Member States of the European Union, Candidate States and certain other States. According to the EPEC PPP Guide (European PPP Expertise Centre, 2011), we can divide the PPP projects into five different models.

The Bottom-Up Model

The Bottom-Up Model consists usually of a group of end-consumers (individuals and/or businesses) who join forces and create an organisation in charge of designing and constructing virtual accessibility infrastructures. In such cases it is common that they receive funding from the government and use private stakeholders (having the technical expertise) to implement the envisaged project. The owner of the output is the organisation. One of the major advantages of the bottom up model is its ability to aggregate demand (especially in scarcely populated areas) ensuring the economic success of the project. Furthermore consumer ownership of the organisation provides assurances that decisions take into account societal priorities.

Private DBO (Design, Build Operate)

The private sector stakeholder receives funding from the public sector and is in charge of designing, building and operating the necessary infrastructures. Ownership of the output and proceeds from the project are usually claimed by the private sector partner, at least for an extended period, in order to achieve investment repayment and profits.

This model has many benefits for the public sector. Using this approach it can employ a commercial operator with experience and technical expertise on the subject, which the public sector usually does not have. Furthermore this approach insulates the public sector from potential losses; this risk is assumed by the private sector.

Similarly the private sector is benefitting from ownership of the project output. Expected profitability covers the (reduced) investment costs, and creates the opportunity for large benefits in the future.

Public DBO (Design, Build Operate)

This model is at the opposite side of PPPs. The public sector authorities design build and operate the entire system. In this case the private sector is reduced to subcontracting during

the implementation phase and to service provision (using the public platform) once the output is operational.

This approach entails several risk factors for the government. All future losses created by the operations of the project output must be covered by the public authorities. Furthermore, as mentioned earlier, it is possible that the public sector lacks the state of the art technical experience for such projects. In this case it is possible that the provided services will be achieved at a higher cost and poorer quality than if they were provided by a private sector stakeholder.

GOCO (Government Owned, Contractor Operated)

This category is also known as public outsourcing. The public sector authorities assign the construction and operation of a virtual accessibility infrastructure to a private stakeholder. However they retain ownership and some control over the output.

This approach can have significant benefits for the public sector stakeholders. Employing the private stakeholder to construct and operate virtual accessibility infrastructures ensures that the project is implemented by a stakeholder having the necessary technical expertise. Retaining ownership and (some) control over the output ensures that subsequent choices are taking into account and reflecting the social policy priorities and preserve public interests. However this model creates adverse incentives to the private stakeholders, who show diminished interest in future investments, due to exclusive public ownership. This might create a deviation from the socially optimum solutions and investment levels.

Public Outsourcing

This model features similarities to the private DBO investment vehicle. Public authorities provide funds to private companies in order to design, deploy and operate the network. However the public sector retains ownership and some control of the network:

The public outsourcing model combines various advantages from a societal point of view. Involvement of the private sector brings commercial and technical expertise into the mix, while public ownership contributes to the long term stability of the scheme. Public ownership of the network ensures that the wider social and economic objectives will be pursued in the future.

There are certain disadvantages that need to be considered. Agreements of this type usually foresee a period, after which operational control reverts to the public sector; combined with the fact that broadband networks usually take long periods to achieve a return on investment, it is possible that incentives for private sector involvement are reduced, due to low expectations

of gains. Attention therefore must be given to the conditions of the agreement. It is also possible that such agreements have conditions that deter further investments. Furthermore the relationship between private and public sector introduces additional bureaucracy that reduces efficiency.

Joint Venture

A joint venture is an agreement where the public and private sector stakeholders share ownership over the output of an investment project. The responsibilities and ownership stakes vary on a case by case basis, and are the core of the negotiated agreement. However it is usual that the private sector is responsible for the construction and operation of all necessary infrastructures, in order to take advantage from the technical expertise of the private sector.

This approach has some advantages over the GOCO agreements in the sense that the private sector maintains some of the risks and expected benefits from the project. As a result it has an incentive to ensure the efficiency and effectiveness of the output. Furthermore participation in profits creates incentives for future investments. From the public sector's point of view, participation in the ownership means that they maintain some control over future decisions. This may be the necessary safety precaution that ensures that public policy goals will also be pursued in the future.

4.1.1 EU regulatory measures

So far, fibre deployment in Europe is rather limited and is lagging behind the level of roll-out (and take- up) of FTTH services in parts of Asia and North America. Where FTTH networks have been rolled out more widely (predominantly in Northern Europe and the Baltic states), non-incumbent operators have often been in the lead. Looking forward, projects funded or led by local authorities, lateral entry into fiber by utility companies and to some extent competing telecommunications operators, are expected to account for the majority of fibre build within Europe. The limited roll-out reflects the fact that the business case for FTTH is challenging. As already mentioned, the required investment is large, most of the costs are sunk as investments cannot be undone if demand turns out to be insufficient, and there is considerable uncertainty about consumer interest in and willingness to pay for ultra-fast broadband.

At present, evidence suggests that end users do not appear to be prepared to pay a premium for higher speeds or additional bandwidth. Amongst other reasons, this may be because users are not fully informed about the differences in the quality of service that would be provided over fiber, or because the benefits from improved connectivity depend on the availability of services that fully exploit the greater speed and reliability, but which users have not yet

experienced. The fact that services that would drive the take-up of fiber might not be developed quickly unless the infrastructure is in place and unless service providers and network operators can be coordinated effectively means that the full value of FTTH networks may not readily be realised, delaying or suppressing investment. In addition, there may be wider societal benefits associated with widespread fiber deployment, which are not (fully) reflected in the willingness to pay of end-users.

On this basis, there would seem to be a good public policy case for promoting faster roll-out of FTTH networks across Europe. The existing regulatory framework should be applied in a manner that is conducive to fibre investment, and additional policy measures might be needed to deal with the fact that the societal value of a fiber-based access infrastructure is not fully reflected in the business case for fibre investment. There is a wide range of tools and instruments available to public players for the improvement of broadband connectivity and accessibility, originating both from the supply as well as the demand side. The supply side tools aim at the expansion of broadband availability through the reduction of the cost of supply, whereas the demand side tools aim at the stimulation of utilization of broadband services.

The most important policy instruments can be broadly categorised as follows:

- Streamlining of regulation: instruments that aim at reducing bureaucratic costs involved in the deployment of new networks or in reducing the time required to comply with administrative rules. Reducing the cost of broadband access infrastructure: all kinds of actions towards the development of broadband infrastructure (finance and deployment of passive and active infrastructure, FTTH, Wi- Fi technologies etc.)
- Increase value of broadband access: all types of instruments that aim at increasing and promoting broadband and ICT awareness, ICT skills, the quality of broadband experience and the availability of useful content (e.g. targeted information campaigns, ICT training programmes for businesses, eRgovernment programmes etc.)
- Reduce the cost of broadband access: instruments like demand subsidies (provided in the form of discounts on the purchase of equipment and/or broadband services, direct subsidies etc.) and/or tax reductions and deductions.

The European Union has long now recognized the need for and the role of public interventions in the development of the electronic communications market and has taken action through a series of measures framing the European broadband policy. Most of the proposals and measures target at the reduction of the deployment cost, as the roll out of broadband networks remains the main discoursing factor for broadband network investments. The EU is trying to advance broadband diffusion and eliminate the digital gap (especially through specific actions of the fourth pillar of DAE) by enhancing market competition, establishing a consensus on national broadband policies, improving access to networks and radio spectrum,

providing a number of funding opportunities and financial aid to (public and private) investors, as well as reinforcing the knowledge about the benefits of broadband services. The main EU recommendations for the improvement of the electronics communications market and broadband networks are next presented. These recommendations will be analytically reviewed and then used as points of reference for the assessment of needs, gaps and / or convergence fields in improving virtual accessibility in the consortium countries. It is noted that, EU policy recommendations are considered to be the most appropriate tool for the extraction of the desired results, as they constitute common ground for policy analysis among the SIVA countries, the latter being either already members or candidate countries of the European Union.

EU regulatory framework for electronic communications

We have already presented aspects of the EU regulations in the previous chapter, focusing on the potential of sharing telecommunication infrastructures. In this section, we present EU legislation and recommendations regarding all aspects on the improvement of electronic communications. The adoption of the EU electronic communications reform package in November 2009 paved the way towards strengthening the European electronic communications market by revising rules to ensure more effective competition and better rights for consumers. Much has been accomplished already: the market has become more competitive, generating investment, innovation and growth in all 27 EU Member States. New communication services have emerged and EU citizens now benefit from lower prices, better quality and increased transparency. However, the common rules for the regulation of electronic communications networks and services are being implemented in the Member States with different degrees of effectiveness. As a result, many operators and citizens still perceive Europe as being a patchwork of different regulatory regimes. More efforts are therefore still needed to move towards a single market for electronic communications.

The revised EU framework constitutes the basis for a supportive and consistent regulatory environment targeting remaining challenges. They reinforce competition while enhancing incentives to invest. New provisions on freeing radio spectrum will improve the availability of new wireless services, including wireless broadband, at reasonable costs. The new body of European regulators (BEREC) will improve cooperation between national regulators and the European Commission. This will lead to the creation of a common "regulatory culture", to more consistency, and to a real single market for electronic communications networks and services.

Legislation for unbundled access for copper based networks

Unbundled access to the local loop has been identified as an essential element of the Digital Agenda. It is a prerequisite for allowing Europe to match its global competitors on Internet use.

Introducing competition on local copper networks will allow high-speed, fixed-price access to the Internet to spread rapidly throughout Europe.

The regulation aims to address the problem of the lack of competition on the local network where incumbent operators continue to dominate the market for voice telephony services and high-speed Internet access. Allowing new entrants access to the local loop infrastructure will lead to increased competition and stimulate technological innovation on the local internet access market. This will encourage the provision of a large range of competitive electronic communications services.

Regulator independence

National Regulatory Authorities are responsible to promote competition in the provision of electronic communications networks and services, and more specifically for:

- ensuring that users derive maximum benefit in terms of choice, price and quality;
- encouraging efficient use and management of radio frequencies and numbering resources.

The NRAs must also contribute to development of the internal market, in particular, by:

- encouraging the establishment and development of trans-European networks and the interoperability of pan-European services;
- cooperating with each other and with the European Commission to ensure the development of consistent regulatory practice and application of the new regulatory framework for the telecommunications sector.

Lastly, the NRAs must promote European public interests by:

- ensuring that all citizens have access to a universal service, as specified in the "Universal Service Directive";
- ensuring the availability of simple and inexpensive dispute resolution procedures;
- contributing to ensuring a high level of protection of personal data and privacy (the "Privacy and Electronic Communications Directive").

Independence

Member States must guarantee the independence of national regulatory authorities (NRAs) by ensuring that they are legally distinct from and independent of all organisations providing electronic communications networks, equipment or services. The NRAs, responsible for the ex ante regulation of markets, must not accept instructions from any other body.

Right of appeal

Effective national mechanisms must allow any user or provider of electronic communications networks or services the right of appeal to an independent appeal body in the event of any disputes with an NRA. Member States shall provide information related to appeals to the Commission and to BEREC.

Impartiality and transparency

Member States must ensure that national regulatory authorities exercise their powers impartially and transparently. They must also ensure that the NRAs make arrangements for consultation of the interested parties if they intend to take measures which could have a significant impact on the market. The NRAs are responsible for making the results of the consultation public.

Consolidation of the internal market

The NRAs, the Commission and BEREC must cooperate to determine the instruments, as well as the most appropriate solutions, to deal with any situation which may arise within the internal market for electronic communications. In certain cases, the Commission has the power to refuse measures proposed by the NRAs.

NGA recommendation

The regulation of access to Next Generation Access Networks (NGA) constitutes a crucial step towards achieving the goal of the Digital Agenda. This Recommendation therefore defines a common regulatory approach as regards access to the new very fast broadband networks using optical fibre, to offer a balance between encouraging investment and maintaining competition.

Legislation for unbundling wholesale access for NGA networks

The aim of this Recommendation is to foster the development of the single market by enhancing legal certainty and promoting investment, competition and innovation in the market for broadband services in particular in the transition to next generation access networks (NGAs).

It regulates the access to wholesale physical network infrastructure (Market 4) as well as the wholesale broadband access (Market 5) through explicit provisions for access to civil engineering works by telecom operators, infrastructure sharing and local loop unbundling.

Cost reduction for deploying broadband networks

Deployment of high-speed broadband networks is subject to various inefficiencies and bottlenecks which lead to high costs for undertakings wishing to deploy networks, especially in rural areas. The dominant cost (up to 80%) in deploying new networks is linked to civil engineering works. Therefore it is necessary to adopt measures tackling these inefficiencies and to bring down the civil engineering costs in order to incentivize infrastructure rollout.

The Commission intends to work on the adoption of the regulation aimed at tackling:

1. inefficiencies or bottlenecks concerning the use of existing physical infrastructure (such as, for example, ducts, conduits, manholes, cabinets, poles, masts, antennae, towers and other supporting constructions),

2. bottlenecks related to co-deployment,

3. inefficiencies regarding administrative permit granting, and, finally

4. bottlenecks concerning in-building deployment.

In practical terms, thanks to the regulation the owners of all infrastructures, e.g. electricity, gas, water, sewage, suitable to host electronic communications network elements will need to coordinate their works. Local authorities will need to issue fewer permits. The implementation of proposed measures is expected to incentivise rollout and facilitate investments by decreasing the associated costs by up to 30 %. It is estimated that the total amount to be saved on deployment could reach over € 60 billion.

Radio Spectrum Policy Program

Access to radio spectrum is essential for a vast range of activities: from telephony and broadcasting, through to transport and space applications. But it is also crucial to ensure that EU citizens in both urban and rural areas can benefit from digital technology and fast broadband connections.

The Radio Spectrum Policy Programme (RSPP) defines the roadmap for how Europe can translate political priorities into strategic policy objectives for radio spectrum use.

On 14 March 2012, the European Parliament and Council approved the first Radio Spectrum Policy Programme. This Decision creates a comprehensive roadmap contributing to the internal market for wireless technologies and services, particularly in line with the Europe 2020 initiative

and the Digital Agenda for Europe. The Decision sets general principles and calls for concrete actions to meet the objectives of EU policies.

The RSPP covers all types of radio spectrum use that affect the internal market and sets general regulatory principles, policy objectives and priorities. The programme aims to enhance the efficiency and flexibility of spectrum use, as well as preserving and promoting competition. By supporting specific spectrum needs (such as for wireless broadband communications, transport, environment protection, Earth surface monitoring or research and space exploration), the RSPP objectives are rooted in the overall goals of the EU's Radio Spectrum Policy.

Universal Service Directive

The European Union intends to ensure the availability of a minimum set of high-quality services that are available to all users at an affordable price, without distortion of competition. It therefore lays down obligations with regard to the provision of certain mandatory services, such as the retail provision of leased lines. It also establishes end-users rights and the corresponding obligations of undertakings that provide publicly available electronic communications networks and services.

Directive 2002/22/EC defines universal service as the "minimum set of services of specified quality to which all end-users have access, at an affordable price in the light of specific national conditions, without distorting competition". Representative provisions of the Directive follow.

Availability of the universal service

Member States must ensure that the electronic communications services detailed in the Directive are made available to all users in their territory, regardless of their geographical location, at a specified quality level and an affordable price.

Provision of access at a fixed location and telephone services

A fundamental requirement of universal service is to provide users on request with a connection to the public telephone network at a fixed location and at an affordable price. The connection provided shall enable end-users to take charge of voice communications, facsimile communications and data communications, at data rates that are sufficient to permit functional Internet access, the provision of which may be restricted by Member States to the end-user's primary residence. There should be no constraints on the technical means by which the connection is provided.

Affordability of tariffs

The Member States shall ensure that consumers with low incomes have access to special tariff arrangements or are given special assistance to enable them to have access to the network and to use it. The special tariffs must either be provided by the designated undertaking, or already be available on the market. Furthermore, the Member States may require undertakings which have universal service obligations to comply with price caps or to apply common tariffs, including geographical averaging, throughout the national territory.

Quality of service

The national regulatory authorities must set performance targets for undertakings with universal service obligations and monitor compliance with these targets by designated undertakings.

Financing of universal service obligations

In order to compensate for the net costs to which the provision of universal service might give rise, compensation mechanisms for operators with universal service obligations may be provided for. This may involve the introduction of a mechanism to compensate from public funds and/or a mechanism to share costs between providers of electronic communications networks and services.

Public financing in line with EU competition and State aid rule

To achieve the objective of access to Internet speeds of above 30 Mbps it is estimated that up to EUR 60 billion of investment would be necessary and up to EUR 270 billion for at least 50% of households to take up Internet connections above 100 Mbps. Such investments shall primarily come from commercial investors. However, the DAE objectives cannot be reached without the support of public funds. For this reason, the DAE calls on Member States to use 'public financing in line with EU competition and State aid rules' in order to meet the coverage, speed and take-up targets defined in EU2020. Demand for capacity-intensive services is expected to increase in the future, as cloud computing, a more intense use of peer –to-peer technologies, social networks and video on demand services will develop further.

Applying this principle to the broadband sector, the Commission considers that in areas where private investors have already invested in a broadband network infrastructure (or are further expanding the network) and are already providing competitive broadband services with an adequate broadband coverage, setting up a parallel competitive and publicly funded broadband infrastructure cannot be considered as a service of a general economic interest (SGEI). However,

where it can be demonstrated that private investors are not in a position to provide in the near future adequate broadband coverage to all citizens or users, thus leaving a significant part of the population unconnected, a public service compensation may be granted to an undertaking entrusted with the operation of an SGEI. In this respect, the networks to be taken into consideration for assessing the need for an SGEI should always be of comparable type, namely either basic broadband or NGA networks.

Regulatory measures to promote competition and enhance the broadband investment environment

On 12 July 2012 Neelie Kroes, the European Commission Vice-President and European Commissioner for Digital Agenda, announced a new policy package to create the legal predictability that investors are asking for against the current overall economic situation in Europe and the substantial roll-out costs of high speed internet. The Commission is preparing a Recommendation on consistent non-discrimination obligations and Costing methodologies to promote competition and enhance the broadband investment environment.

The EU Recommendation on consistent non-discrimination obligations and costing methodologies which implements this policy has been published at the end of 2012. There is no evidence that it has been already incorporated in national legislations. It does have the approval of BEREC though, the Body of European Regulators for Electronic Communications which represent the national regulatory authorities.

Member States to develop national broadband plans

Today, almost all Member States have a broadband strategy. Most of them focus on complete coverage for basic levels of broadband (i.e. adequate for email, routine surfing and administrative services). Very few of them set clear operational measures to achieve:

- Real competition among broadband providers that would lead to affordable prices for consumers;
- The roll-out of high-speed internet, both in terms of timing and funding.

Developing comprehensive national broadband strategies will stimulate investment in fast internet access beyond current market levels. Ultra-fast internet will enable new services based on higher bandwidth needs to become available on a daily basis. In March 2012, the Commission presented a Staff Working Document on national broadband plans. This summarised that state of play and provides a reference point to assist and co-ordinate national planning.

4.1.2 Adoption of EU recommendations by SIVA countries

For the assessment of needs regarding the improvement of broadband access and for the identification of possible gaps existing in the process towards a common approach of virtual accessibility enhancement, we will mainly examine the level of adoption of the EU policy recommendations aforementioned, by each consortium country. More particularly, we have identified a number of dimensions and policy issues that are on the one hand largely addressed in the EU recommendations and on the other hand are very specific and relevant to the improvement of broadband access as described and foreseen by DAE. For the convenience of making comparisons as well as for the assurance of the quality of the comparisons made, these policy issues are categorized and presented so as to be as much as possible in line with the actions of DAE regarding the provision of fast and ultra – fast Internet access.

The issues under examination involve the following:

- National Broadband Plans
- Public financing and state aid
- Radio spectrum management
- Deployment of NGA / Civil infrastructure initiatives / cost reduction of network deployment / unbundling and wholesale access
- National mapping of broadband coverage
- Facilitate broadband investments through improvement of administrative procedures

For each consortium country a small profile briefly describing the progress made at a national level to address these issues is next presented.

Austria

The new broadband plan of Austria (Broadband Strategy 2020) has already been developed and released by the Federal Ministry of Transport, Innovation and Technology (bmvit) since 2012. The strategy outlines a number of new targets and measures for the nationwide rollout of ultrafast broadband. It is largely aligned with the targets of DAE as one of its main aims is to have at least 100 Mbps services available across the country by 2020.

As far as funding opportunities are concerned, Austria used ERDF funding to roll-out broadband from 2004 until 2006. At present, Austria allocates resources for broadband / NGA deployment along the European Recovery Plan via the rural development fund. Currently, the main funding programme of Austria is the "Broadband Austria 2013" (BBA 2013), where the first round of calls has already finished. The co-funded projects of the programme are designed to cover 143 selected rural areas with high bandwidth broadband until the end of 2013. It

should be mentioned that, some Austrian provinces still use ERDF funding to co-finance projects within the framework of BBA 2013. The goal is the funds to be completely allocated by the end of 2013.

In preparation of the funding programme "Broadband Austria 2013" a mapping of broadband coverage was preceded with the consultation of the main Austrian Internet providers. The mapping showed regional disparities of retail broadband coverage (white spots) and of NGA coverage (white and grey spots).

One of the main initiatives of the new strategy of Austria (Broadband Strategy 2020) concern the simplification and improvement of administrative procedures of network deployment, through the creation of a new broadband office meant to coordinate the implementation of the government's broadband strategy. The new office of the Federal Ministry of Transport, Innovation and Technology (BMVIT) aims at strengthening the inter-sectoral cooperation between Internet-providers and utility companies and between regional authorities. In addition, the revised Austrian Telecommunication Act (11/2011) contains amended provisions with regard to administrative procedures concerning rights of way.

With regard to energy efficiency and cost reduction of network deployment, the Austrian Telecommunications Act also simplifies procedures to provide infrastructure mapping. Recipients of "Broadband Austria 2013" have to report their raised infrastructure in a GISR data-file. Then, interested subscribers can get information about the possibilities of co-deployment.

In general, the principles of the Radio Spectrum Policy Programming are already implemented in the Austrian regulations, but further amendments are ongoing. The spectrum inventory is subject to an EU wide coordinated process that started in 2013 and relevant harmonization measures are in preparation on EU level.

Bulgaria

Bulgaria has prepared an (updated) National Strategy for Development of Broadband for the period 2012-2015 with links to 2020, which is accompanied by a National Operational Plan for the implementation of its strategic goals. The two documents are consistent with the guidelines and objectives of the DAE.

Concerning funding options, in the framework of Operational Programme "Regional Development" 2007-2013 (OPRD), €20 millions are foreseen for the construction of broadband connections to urban peripheral areas and less urbanized territories and rural areas and for the development of critical, secure, dependable and trusted public-owned infrastructure. Sole beneficiary of the aid is the Executive Agency "Electronic communication networks and information systems" (EA ECNIS). The relevant proposed funding project ("Support for

development of critical, protected, secure and reliable ICT infrastructure") aims at the deployment of a NGA network in 19 pre-selected remote and peripheral regions of Bulgaria. The scheme for implementation of the project is currently in a process of pre- notification, as the services of EC stated that it involves state aid and should be notified. The allocation of the funds will be achieved only if the EC approves the notified measure.

In the Bulgaria's National Operational Plan, a series of accompanying activities are set to help achieve the objectives set, such as coordination of regional development plans with national strategic objectives, analysis of the communications operators investment plans, creating a database and map of existing communication infrastructure, implementation of coordinated measures and actions to support the investment process and other.

A mapping of the country's broadband coverage was realised as part of the pre-investment study that accompanied the proposal for the aforementioned funding project. Bulgaria has taken measures considering the streamlining of administrative procedures for the improvement of broadband investments under the Electronic Communications Act (Chapter Seventeen - "Establishment and Maintenance of Electronic Communications Networks and Infrastructure Right of Way").

No initiatives of civil broadband infrastructure for the encouragement of new operators into the market have been recorded. The principles of the Radio Spectrum Policy Programming (RSPP) have not yet been fully implemented by Bulgaria. Their implementation is still in progress and requires further amendments.

FYROM

Despite FYROM not being an EU Member State yet, many of its actions have been driven by developments in the European Union and the political will of SEE countries to ultimately become Member States. FYROM and its neighboring countries have sought to adopt a legal framework compatible with the EU framework. The strongest driving force towards broadband development is FYROM's decision to apply for EU membership, which has triggered many subsequent legal and regulatory activities (Broadband Commission, 2012).

Considering the gaps in technology, infrastructure, legislation and income levels which existed at the start of FYROM's rapprochement to the EU in 2000, the development of the electronic communications markets and Information Society services can be seen as a considerable success in FYROM. Necessary legal steps for the liberalization of its electronic communication markets have been initiated as early as 2005. The implementation of the EU Regulatory Framework from 2005 onwards triggered competition in both fixed and mobile network markets, leading to a steady development of market volumes, diversity of services and

affordable prices. The broadband penetration rate of 32% of the population indicates that a relatively broad public can afford broadband services. The Government of FYROM decided on its Information Society Strategy in 2005 by adopting a set of Strategic Directions concerning their national strategy for the development of electronic communications with information technologies (Ministry of Transport and Communications, 2005). The execution of these Strategic Directions is developed further in their strategic document, "Broadband Nation; National Strategy for Development of the Next-Generation Broadband Internet with an Action Plan" (Ministry of Transport and Communications, 2009). This document can be seen as a national broadband strategy, and it makes a clear statement and commitment to the development and promotion of broadband access.

AEK, the national regulatory authority has undertaken the necessary steps to have comparable powers as the NRAs of some other EU Member States and will continue to take further steps to create favorable market conditions for electronic communications companies and most importantly for the Macedonian citizens.

The strategy of the AEK (Agency for Electronic Communications) is to implement all provisions of the NGA Recommendation foreseen in the DAE, including access to civil engineering infrastructure (in 2012) and access to fibre networks (in 2013). AEK has already implemented a cadaster of all telecommunication infrastructure (mapping) as an information base for potential investors in fiber based access networks, while an additional one-stop shop system for building licenses for telecommunication infrastructure is on its way.

AEK plans to undertake the necessary steps to create a favorable market environment for the deployment of LTE and other high-speed mobile data services. These steps include a fundamental change in procedures for frequency allocation (which will require a change of the Telecommunication Law), measures to support cost savings in network roll-out as infrastructure sharing, and "refarming" of 900MHz and 1800MHz spectrum, as outlined in the Radio Spectrum Policy Programme. Regarding the digital dividend AEK considers license obligations for 800 MHz licenses to promote the roll-out of 4G services in less densely populated areas. AEK has already made plans for freeing the frequencies between 792MHz and 863MHz by 1 June 2013 and has started procedures to allocate these frequencies to mobile communication services.

Summing up, there are a few gaps that remain to be closed in the existing legislation and it is up to AEK to implement and execute their strategy to be completely compatible with the major EU initiatives and programmes. With regard to the obligations under the Digital Agenda, FYROM has already taken almost all the requested actions to promote the goals of the Digital Agenda in the area of regulation and respective legislation.

Greece

The National Plan of Greece for broadband services is part of the country's Digital Agenda 2008-2013 and its implementation was assigned to the Special Secretariat for the Information Society of the Ministry of Economy. The plan is focused to provide broadband access to all and to facilitate the smooth transition to Next Generation Networks (NGNs). Co-funding by Greece and the EU is scheduled through the Operational Program "Digital Convergence" for two of the investments plans that are part of the country's broadband development roadmap, namely the "Rural broadband Project" and the "MANs exploitation Project". Nevertheless, the foreseen funds are not yet allocated to the two projects and are not expected to be fully allocated until the end of 2013.

No initiatives have been reported regarding the mapping of broadband infrastructure or the cost reduction of network deployment.
Greece has taken some steps towards streamlining administrative procedures in order to improve broadband investment conditions. Most of them concern legislative interventions that are either completed or are in their final step such as (a) Revision of national law on electronic communication 3431/2006 and transposition of the Telecom Reform Package by the new law 4070/2012, (b) Rights of Way for Electronic Data Networks, (c) Improvement of Antennas Installation Licensing, (d) National Security Plan for Communications, (e) Specifications for internal communication networks and (f) National Frequency Allocation Plan.
The implementation of the Radio Spectrum Policy Programming has not yet been fully achieved by Greece and is still in progress.

Italy

Italy has recently set up the Agency for Digital Italy which is responsible for implementing all the provisions of the Digital Agenda for Europe. A National Plan, the Decree Digitalia, has been drafted and approved by the Parliament, which sets out the same targets as those of the DAE.

Italy has been the first to use the European Agricultural Fund for Rural Development (EAFRD) for funding broadband investments, and has been the country which used it the most through a coordination of all the regions involving also the Ministries of Agriculture and Economic Development. Some regions have even contributed from own funds to increase funding resources for broadband development in order to bridge the digital divide for rural areas. Moreover the action of the Development and Cohesion Department provides €700Milliion for broadband development in southern Italy, which will enable a broadband population coverage rate of 40-50% before 2015. An additional strategic project for ultra- fast broadband which foresees 30Mbps universal population coverage and 100Mbps for 50% of population by 2020 awaits EC's approval.

To effectively realize this plan and achieve the target coverage rates, it will be crucial to set up a register which will gather information regarding the mapping of available broadband infrastructures. This is foreseen by Decree Digitalia, but not yet in place.

Italy reports one of the most competitive broadband markets in the EU. New directives regarding cost reduction for broadband deployment and civil infrastructure planning have not been adopted, presumably due to the lack of significant market failures. With Deliberation n. 731/09/CONS signed on the 16th of December 2009, the Italian Telecom regulator AGCOM approved a new set of regulatory rules for granting access to new NGN infrastructure and fostering its deployment. The approach followed by AGCOM is the principle of equivalence of access to new NGN infrastructure. In line with the European Commission's draft Recommendation on NGAN, AGCOM imposed on Telecom Italia, (the SMP operator in the market for access to the fixed telephony network) the following set of remedies:

- Obligation to provide access to its passive infrastructure, in order to give the opportunity to alternative operators to install their own fibre cables in existing ducts
- Obligation to provide access to dark fibre

In addition, through the new the Italian broadband plan (the Decree Digitalia), the Italian authorities aim at covering all the local broadband projects under one umbrella, and in particular to ease administrative burden on smaller granting authorities and to accelerate broadband investments. The implementation of the Radio Spectrum Policy Programming (RSPP) has not yet been fully achieved by Italy; a competition is currently under way to re-farm the frequencies.

Montenegro

Montenegro has not yet developed a national broadband strategy in the form of a separate policy paper. Nevertheless, the need for the promotion of broadband in general along with a set of provisions for the fulfillment of that need come as part of its Strategy of Electronics Communications Sector (ECS) developed in 2006, as well as its Strategy for Information Society Development, both for the period 2004-2007 (adopted in 2004) and for the period 2009-2013 (adopted in 2009).

The main goals of ECS are (a) the improvement of capabilities, prices and performances of the electronic communication services in general, so as to become competitive within a broad benchmark of European countries, and (b) the substantial and growing usage of on line information and transaction services by residents and businesses in their interactions with the government and for their own business, commercial and social purposes. The government of

Montenegro seeks to achieve these goals through a number of means, the most important for broadband being:

- Sector regulatory reforms, so as to become harmonized with the principles and policies embodied in the Directives of the European Union and facilitate progress towards the preceding goals
- Efficient use of scarce resources and in particular of spectrum
- Creation and enhancement of awareness of the value of ECS and Montenegro's ICT infrastructure and services.

Through its Strategy for Information Society, the government of Montenegro tries to achieve the main objective of e-Europe, namely to promote the digital era, inter alia through the enhancement of fast internet access. The Information Society Strategy identifies the growth of broadband as a key national priority, projecting to achieve the Digital Agenda for Europe objectives by 2016. Apart from legislative measures regarding the regulation of the ICT market operation, the broadband plan of Montenegro remains in its great part very general. As far as the implementation of DAE is concerned, the preparation at national level is largely in line with the requirements set, but the country's broadband objectives are not yet aligned with the broadband objectives of the DAE. According to the last screening report prepared in the framework of the country's EU accession process (European Commission, 2013), the government of Montenegro stresses the need to advance further the broadband actions in a national level.

Based on the same report and regarding radio spectrum policy, Montenegro states the need to fulfill the requirements on the conditions for the availability and effective use of the radio spectrum under Decisions 2002/676/EC and 2012/243/EU. In addition, Montenegro stated that rights of way are dealt within the Law on Legal Property Relations. The new draft law on electronic communications will also include provisions on the rights of way, as well as for facility sharing. As far as Montenegro's telecom sector is concerned, its liberalisation has been guided by legislation which adopts the regulatory principles found in the EU's regulatory framework for communications. This was updated in 2010 with the revised regulatory framework.

Fixed broadband services are available via a variety of technology platforms including DSL, cable, leased line and wireless. The fiber sector has shown particularly strong growth since 2010 as the incumbent has invested in infrastructure upgrades, albeit mainly to serve apartment blocks in the main towns. DSL is also strong given the legacy reach of the incumbent's copper network, coupled with its existing market presence and range of service offerings that include broadband TV.

Mobile penetration is among the highest in Europe, though this is partly due to the significant number of tourists visiting the country seasonally, as also the predominance of popular prepaid cards WCDMA/HSPA networks have been launched, which has formed the basis for new mobile broadband services.

The most important trends of the broadband market, indicating the level of broadband access and market competition are the following:

- Fixed broadband uptake continues to grow due to improving affordability despite adverse economic conditions. Supporting growth is high levels of PC usage for the region.
- The number of fibred premises more than doubled in 2012, marking operators' willingness in investing in next generation services and infrastructure.
- Both fixed-line and mobile infrastructure sharing has been encouraged by the regulator to save unnecessary network construction costs. Prices for LLU and shared access to the incumbent's fixed network were set in mid-2012.
- Telenor and T-Mobile Montenegro have begun trials of LTE, with the 900MHz and 1800MHz bands available.

Slovenia

Slovenia has introduced in its National Broadband Plan its own targets, which are close but not fully aligned with those of the DAE:

1. Basic broadband coverage: Broadband infrastructure has to enable coverage of at least 90% of the population with at least one type of broadband access with the speed that enables more demanding broadband services of minimum 2 Mbps by the end of 2010 and 98% by 2012

2. NGA coverage & take-up: Broadband infrastructure has to enable coverage of 90% of the population with access to triple-play services and at least 20Mbps connection speed by 2015. Broadband infrastructure has to enable coverage of 90% of the population with fibre to the home (FTTH) or comparable broadband connections of greater capacity by 2020.

Slovenia plans to adopt a new National Broadband Plan by the end 2020 in line with DAE. Regarding funding for broadband investments, Slovenia has been using the European Regional Development Fund extensively and is not reporting any use of structural funds. 12 investments projects for broadband deployment have been recently funded in 20 local communities. Today there are 5 investment projects of building BB networks in 23 local communities, carried out on the basis of public private partnerships (PPP) and co-financed by the ERDF funds. Some local communities also probe for information on commercial interest in certain settlements, interest

for infrastructure expansion is starting to exist. No further information and/or announcements are available on this. Slovenia has already absorbed about €45 Million out of the available €82 Million; and has recently contractualized works for an additional €36.7 Million.

The Electronic Communications Act includes many provisions on cost reduction for new entrants and administrative procedures that facilitate investing for broadband deployment. Most of these provisions and/or measures are taken from the EU regulative framework like authorizations streamlining, stimulation of shared use of properties and Capacities interconnections and operators sharing access as well as competition and right of way. Some are specific to Slovenia like the obligatory common use of free capacities from other types of public trading infrastructure, declaring the construction of public communication networks and associated infrastructure to be a public benefit, obligation to enter data on public communication networks into the register of infrastructural networks.

Furthermore the act includes a provision stating that cable ducts shall be considered public trading infrastructure to improve efficiency of land use. The constructed system of cable ducts must be available to all interested operator under the same terms and conditions. Local communities shall within the frame of their power promote the construction of public communication networks. They usually come to agreements with operators for the use of community infrastructure, inform operators about planned further interventions in existing infrastructure and may plan the construction of open broadband networks.

An operational national mapping of retail broadband coverage has been established, which by the end 2013 is foreseen to provide info on different speeds.
Regarding radio spectrum, Slovenia is in accordance with the provisions of the RSPP with the exception of the authorization of the digital dividend for wireless broadband communication use.

4.1.3 Comparative assessment of national policies: main findings and areas for improvement

The main findings of the previous analysis per consortium country are summarized and presented in Table VIII that follows. The table depicts the progress made by the countries under examination in the broadband policy fields that have been identified as the most important and relevant (see previous section). The estimations are mainly based on the findings of the preceding analysis, and they basically refer to the degree of completion of actions taken by each country in each identified broadband policy field, and the degree of each country's policy alignment with the DAE goals.

A close examination of the table's findings, leads to useful conclusions regarding the existing gaps and convergence fields in broadband accessibility in the consortium area, and conclusively it highlights policy fields that needs are identified and further efforts are required regarding the

improvement of broadband access.

Table VIII. Comparative assessment of broadband policy issues and actions

Broadband policy issues / fields of action	SIVA Countries						
	Austria	Bulgaria	FYROM	Greece	Italy	Montenegro	Slovenia
National Broadband Plans							
Public financing & state aid			-			-	
Radio spectrum management							
Deployment of NGA / Civil infrastructure initiatives / cost reduction of network deployment / unbundling and wholesale access		-		-			
National mapping of broadband coverage				-		-	
Facilitate broadband investments through improvement of administrative procedures							

Actions completed: fully or to a satisfactory degree

Actions in progress / incomplete actions

No actions taken / the completion of the actions is delayed

\- No actions reported / no available data for the actions

The most obvious finding is that almost all SIVA countries have incorporated the primary broadband goals of DAE in their policy by developing separate strategic frameworks for the promotion of broadband access and connectivity at a national level. Each country has embedded the provisions of action 46 of the DAE in their broadband strategy to a larger or smaller extent by creating a national broadband plan, which usually sets clear objectives and a number of operational measures to achieve them. According to the findings of the analysis, most national broadband plans are fully or at a great extent aligned with EU recommendations and the goals of DAE. Nevertheless, it should be noted that not all countries' broadband plans are recently updated (e.g. Greece) and should be further revised in order to keep pace with the targets set by DAE for 2020. The need for planning a national broadband policy is most obvious in Montenegro, as it is the only country of the consortium that has not yet developed a national broadband plan in the form of a separate policy paper. In addition, Slovenia's broadband plan targets are close but not fully aligned with those of DAE.

The area of public funding and state aid has been recognized as partly problematic only for some of the consortium countries, like Greece and Bulgaria, where despite the fact that there are the provisions for co-funding of broadband investments by national and European funds, the allocation of these funds is delayed and is still in progress. Thus, a need for better and faster absorption of public funds is identified in those countries of the consortium.

Most of the countries under examination have developed a mapping for the existing broadband infrastructure, some of them as a prerequisite and necessary part of a financing investment

programme (e.g. Bulgaria). No mapping initiatives (at least in a comprehensive way) have been recorded in Greece and Montenegro, whereas in Slovenia there is a mapping of the existing broadband retail coverage, though is does not yet provide information on different speeds of broadband connections.

Efforts towards the facilitation of broadband investment, through the improvement of administrative procedures, are clear in all the consortium countries, at least at the policy planning level. Nevertheless, in countries like Austria and Italy these efforts are more intensive and have been articulated in specific actions (i.e. the broadband office in bmvit in Austria). In addition, a common characteristic of Austria and Italy is that both countries promote reforms aimed at the reduction of broadband' infrastructure deployment cost through the simplification and centralization of all the necessary procedures, as well as through regulatory rules for facilitating and/or granting access to new infrastructure and fostering its deployment. In the rest of the consortium countries, and especially the two under-accession countries (FYROM and Montenegro) the needs for further actions in these fields is identified.

Radio spectrum management arises as the broadband area with the most gaps and needs, as only Austria seems to be at a satisfactory degree aligned with the relevant goals of DAE. Evidence from the countries show that radio spectrum needs to be assigned with greater co-ordination across the European Union.

4.2 Conclusions and recommendations for converging policy pathways for South East Europe

South East Europe contains a number of countries with very heterogeneous characteristics with regard to broadband diffusion and uptake:

- Most countries have difficult terrain, including mountainous areas or many islands and small population densities, which severely degrades the business opportunity for the development and valorization of broadband and NGA infrastructure.
- Some countries have only recently shifted from a closed, centrally planned to a free market economy; local telecom markets were until recently dominated by state- owned operators with monopoly power and there is limited/immature competition in the local telecom market. Furthermore, the policy and regulatory frameworks may need serious adjustments to stimulate competition in a well-regulated environment in accordance with EU regulation and directives.
- Income disparities between South East Europe countries are very large. The area includes countries like Italy, a G20 member, and Austria with a per capita GDP higher

than Germany's, but also includes countries such as Montenegro, Kosovo and Bosnia & Herzegovina which are classified as developing countries by the International Monetary Fund and World Bank.

As a result, the SEE area cannot be treated as a whole. Business and investment related considerations are very different for each country, as disposable income and regulatory/legal frameworks are very diverse. On average though, the SEE area lags behind Northern or Central Europe in terms of economy and telecom market maturity.

The South East Europe countries have already acknowledged this situation and have undertaken initiatives to close the gap with the Central and Northern European countries. The Broadband South East Europe Taskforce has been established with an aim to strengthen cooperation and coordination at the regional level in the domain of broadband technology and to facilitate progress within the following areas relating to broadband:

a) Regulatory framework competence;

b) Human resource, development, i.e. human capital;

c) Modern electronic communication technologies implementation;

d) Development and monitoring of the electronic communication market; and e) Excellence in research.

Making strides toward the improvement of virtual accessibility and broadband penetration, though, will heavily rely on the establishment of an appropriate policy framework in all South East Europe countries. The EU directives related to broadband and the telecommunication market provide a stable, tested and tangible goal, which has served the Northern countries quite well up to now. As a result, the policy amendment efforts of all SEE countries have been converging to the full alignment of their policy frameworks with these EU directives.

The public interventions in the telecommunications market to stimulate the deployment of NGA networks can be classified into three categories:

- Policy/institutional: shape the legal environment and proper institutions to enable private operators to justify investments in fiber roll-out and take steps toward universal population coverage with NGA
- Regulatory: simplify procedures and bureaucracy for licensing investment projects, put in place the proper provisions to foster competition in the market and avoid monopoly situations, to ensure reasonable and affordable access to NGA by citizens, etc.
- Financial stimulation: provide financial incentives for investments in fiber networks

deployment, including grants/subsidies, debt/equity investments, tax incentives, etc.

The following sub-sections outline specifications of policies and other public interventions which aim to facilitate the achievement of universal coverage of South East Europe with NGA networks through the creation of an environment that provides a proper regulatory framework and incentives to motivate investments by private operators or by public private partnerships.

4.2.1 Policy/institutional

Organizational and institutional barriers hamper the necessary innovation and structural changes needed and leave many OECD countries struggling to move beyond pilot projects. The notions of ubiquitous networks, broadband-based home management, and other new forms of broadband use have yet to develop and diffuse.

A wide range of regulations and laws regarding competition, public infrastructure sharing, intellectual property protection and digital rights managements, business licensing, tax, among others, will need to be updated in South East Europe to release the full potential of ultra-fast internet and to facilitate universal deployment and uptake of NGA networks.
The following represent more specific specifications regarding policy and institutional interventions that will pave the road for fiber deployment and uptake.

Broadband as a tool for regional development

Public intervention for the facilitation of NGA network deployment should always target the welfare of all citizens without distinctions. Effective information society infrastructure is becoming the foundation for key services (education, health, communication) that all citizens should enjoy and a major building block for regional competitiveness, accessibility and equality between people.

Public administrations, including local and regional authorities that have a better grasp on particularities of different areas, should play a key role in helping to ensure equal and affordable broadband access in areas for instance where the market fails, in leading pilot projects aimed at bridging the virtual accessibility gap, and in developing new approaches towards people-centered public e-Services.

Public sector preparation

NGA networks and new applications and services based on ultra-fast internet are a new and rapidly growing market. Involvement of the public sector, with the exception of some infrastructure development projects, has been minimal. The European Union, states and public

authorities should create favourable conditions for new types of pre-commercial procurement and awareness raising so as to enhance public sector involvement and readiness for dealing with the radical innovations that lie ahead. It is imperative that governments and local authorities understand the power, impact and implications of NGA networks in order to shape the environment for efficient proliferation to the benefit of citizens. Public authorities should already be part of pre-commercial research and development efforts in order to be able to put in place the necessary regulatory and legislative frameworks in time.

4.2.2 Regulatory

Governments that have chosen to focus on infrastructure based competition must create a competitive market environment that provides investment incentives for competitive operators and incumbents. Given the size of the capital investments required for building NGA infrastructure, they should moreover encourage infrastructure development and use sharing schemes both between private operators as well as between private operators and public authorities. Governments that have historically relied on unbundling for competition will need to evaluate the role and future of unbundling in next generation networks, and should also facilitate infrastructure based competition.

Streamlining of administrative procedures

Governments should be orientated towards initiatives aimed at the reduction of bureaucratic costs involved by the deployment of new networks and / or at accelerating the time required to comply with administrative obstacles. These actions could involve for example setting time limits to the procedures needed to obtain excavation permits and rights of way, creating streamlined dispute resolution of rights of way disputes, the creation of central points of coordination for broadband initiatives etc.

Competition stimulation through pricing of wholesale access to fiber infrastructure

The European Commission's Next Generation Access (NGA) Recommendation provides national regulators with a framework for dealing with the specific challenges faced by investors in fibre networks by allowing them to include a sufficient risk premium when setting regulated access charges for fibre networks, and to take account of specific strategies for sharing and reducing the risk of fibre investments. There is a delicate sweet spot that must be found for this premium; if it is too low it hampers private investments on NGA deployment and the public sector will have to take the burden of financing the investments, if it is too high competition may be stifled and this premium will be passed on the retail prices reducing the demand and eventual uptake of ultra-fast internet services. Both these extremes have a severe negative effect on the achievement of the Digital Agenda target, hence special attention is required in

setting the risk premium. These recommendations are only now beginning to be implemented by European countries, and there is consequently some uncertainty over how fiber networks will be regulated in practice.

Monitoring broadband plan execution progress

Most South East Europe countries have already developed broadband plans which lay down specific targets which should be achieved regarding population/geographical coverage within specific timelines. However, few countries have specific broadband policy assessment and evaluation activities which would allow them to carry out existing broadband plans in a more effective and accountable manner. Internationally comparable broadband metrics are needed to meet this goal.

4.2.3 Financial stimulation

Technology neutrality and open access

Any government intervention in markets that involves funding should follow a set of basic rules. Requests for proposals should be technologically neutral and simply specify the minimum criteria for the project. Any new infrastructure built using government funds should also be open access – meaning that access to that network is provided on nondiscriminatory terms. This can be achieved using a layered network architecture and a business model that separates physical access to the network from telecom service provision. These conditions set the stage for creation of a competitive market without distortions, most notably monopoly situations due to vertically integrated providers who will not provide infrastructure access to other service providers.

Exploit European funding instruments for regional development

Leverage European funds (Connecting Europe Facility, Structural Funds, Regional Development Funds) to enable the state to participate in fiber deployment investments and assure that all citizens reap the benefits of broadband equally. The European Commission has made funds available through the aforementioned funding instruments. National governments and public administrations, however, should strive to set up the necessary authorities and frameworks that will maximize absorption of funds and ensure proper management for the benefit of citizens.

4.2.4 Other actions

Broadband demand stimulation

Governments have to renew efforts to put government services and government content online. The development and availability of e-government services and broadband applications can bring significant benefits on multiple fronts for the public sector and citizens: they can help organise the public sector more efficiently, they can reduce bureaucracy and corruption, they can improve citizen accessibility to public services and they can stimulate demand for broadband services. Despite all these benefits, they have not been developed sufficiently in the countries of South East Europe.

Facilitation for the development of added value services

Demand for broadband services depends significantly on complementary services which have an impact on the welfare of consumers, broadband as a technology does not affect their lives. The entertainment, communication, health, and other services delivered over broadband connections have the direct impact on citizen's everyday lives. Hence, these added value services on top of broadband connectivity are a key ingredient for the uptake of broadband. They are typically a product of user driven innovation and are usually developed by entrepreneurs and SMEs which require a flexible legislative and regulatory framework in order to operate and flourish. Public authorities should recognize this fact and adjust their related legislation involving, for instance, procedures for starting a business.

Funding instruments

Grants

An accurate definition of Grant is the following: A grant is "bounty, contribution, gift, or subsidy (in cash or kind) bestowed by a government or other organization (called the grantor) for specified purposes to an eligible recipient (called the grantee). Grants are usually conditional upon certain qualifications as to the use, maintenance of specified standards, or a proportional contribution by the grantee or other grantor(s)." For the purposes of our analysis a grant would be money that a government/bank/supranational organisation gives to a national or regional stakeholder for the implementation of a virtual accessibility project. The most important feature of a grant is that the grantor does not expect repayment of the funds by the grantee (conditional on the grantee fulfilling all his other obligations).

In the case of a grant the grantor provides financing for the implementation of an investment project without expecting repayment from the grantee. Grants are usually provided by individual countries (possibly through specialised agencies) or by large international organisations, that have an independently administrated budget which is financed by

sovereign countries and other benefactors (EU, UN). Eligibility criteria for an investment project can include characteristics such location, scope, magnitude and expected impact. Another determining factor is usually prosperity in the area, which is usually measured with GDP per capita or other similar indexes. For USAid (United States Agency for International Development) determines eligibility according to 7 strategic goals for projects located outside the USA. Similarly the UNDP (United Nations Development Program) finances projects in some of the poorest countries and regions in the world. In general, apart from projects funded with grants allocated from national budgets domestically, there are several major international institutions that can provide financing. The organisation with the most available funds is the European Union with its various policy instruments (Structural Funds, CIP, IPA etc) with a budget exceeding €400bn over a 7 year period (2007 - 2013). Another important organization is the UNDP (United Nations Development Programme). In the category of programs funded by individual countries USAid stands out, both in terms of budget and geographic scope. All those institutions can be used to fund projects in the virtual accessibility area. However USAid and UNDP are focused more on less developed countries, and therefore activities will have to be related to the provision of more basic services with an attention to improving governance, democracy and government effectiveness. For countries in South East Europe in general and the SIVA consortium in particular the most important source of financing is the European Union. However not all those countries are eligible to the same funds from the EU. The most important distinction is between EU members and prospective members. The latter have only access to the Instrument of Pre-Accession (which has a rather limited budget) while the former have access to all the important, in terms of available budget, EU funds (the Structural Funds, the CIP, Connecting Europe) Grants could be used to finance a variety of investment projects. Such would include a project were only the public sector is involved, as well as projects where a public – private partnership is foreseen.

Structural Funds

All EU Member Countries have access to the three Structural Funds:

- European Regional Development Fund (ERDF)
- European Social Fund (ESF)
- Cohesion Fund.

The structural funds have a consolidated budget and three core policy objectives. However money is transferred from the EU to the eligible countries through each of the structural funds. Each policy objective is pursued by more than one fund, and not all objectives are covered by every fund. The policy objectives and the allocated funds for the period 2007 – 2013 can be found in the following table:

- Convergence
- Competitiveness and Employment
- European Territorial Cooperation

The ERDF has a mandate for investments related to telecommunications in general, and information society in particular; however the ESF can also be used for some investment projects related to virtual accessibility. Using these objectives national governments can formulate operational plans that are aiming at virtual accessibility infrastructures and receive funding for their implementation. In a similar way funding can be acquired from the ESF, the objectives of which include the improvement of public services. In this vein funds can be directed to improving the quality and efficiency of public services. Designing the operational project is part of central government policy. However those government authorities can direct the funds to whichever stakeholder they consider appropriate for the most effective and efficient realization of a strategy. As a result, depending on the conditions of the operational program, eligible stakeholders could be regional public authorities, municipalities as well as private stakeholders (telecommunication companies, consumer associations etc.).

Competitiveness and Innovation Framework Programme (CIP) Grants

Another source of financing is the CIP. The CIP has four general objectives as described in article 2 of the CIP legal base:

- to foster the competitiveness of enterprises, in particular of SMEs;
- to promote all forms of innovation including eco-innovation;
- to accelerate the development of a sustainable, competitive, innovative and inclusive information society;
- to promote energy efficiency and new and renewable energy sources in all sectors, including transport.

In order to pursue those objectives the CIP is comprised of three specific programmes which have their one objective:

- the Entrepreneurship and Innovation Programme (EIP)
- the ICT Policy Support Programme (ICT-PSP)
- the Intelligent Energy Europe Programme (IEE)

Of particular interest is the ICT-PSP pillar of the CIP program. The CIP does not specifically cover the development of broadband infrastructures that are at the core of the present deliverable. However its emphasis on innovation, benchmarking and international cooperation in order to exchange experiences, foster innovation and increase the penetration of ICT in European

societies, can allow for investment projects and funding mechanisms that facilitate the acceleration of broadband expansion and improve the offered services. Eligible for funding through the CIP are all EU Member Countries. Additionally access to specific activities of the CIP is provided to non-member states:

- Entrepreneurship and Innovation Programme (EIP): Norway, Iceland, Liechtenstein, Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Turkey and Serbia fully participate in the EIP; Israel and Albania participate in certain parts;

- Intelligent Energy Europe Programme (IEE): Norway, the former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, and Croatia;

- ICT Policy Support Programme (ICT-PSP): Norway, Iceland, Liechtenstein, Croatia, Montenegro, Turkey and Serbia.

The available budget for all countries for the period 2007 – 2013 is included in the following table.

Entrepreneurship and Innovation program		2166
Of which eco-innovation	430	
Of which financial instruments	1130	
Of which Enterprise Europe Network	338	
ICT Policy Support Program (ICT – PSP)		728
Intelligent Energy Europe Program (IEE)		728
TOTAL		3621

CIP indicative budget overview for 2007 – 2013 (€ million)

Instrument for Pre Accession (IPA) Grants

Prospective EU member countries can use funds from the IPA. The IPA does not have a specific ICT mandate, and focused more towards regional cooperation and pre accession preparation. In this vein and in order to achieve its goals, the IPA consists of five components which provide financing under a single Umbrella

- Transition Assistance and Institution Building : managed by the European Commission's Directorate General for Enlargement
- Cross-Border Co-operation (with EU Member states and other countries eligible for IPA)
- Regional Development (providing support to transport, environment infrastructure and enhancing competitiveness and reducing regional disparities);

- Human Resources Development (strengthening human capital and combating exclusion): managed by the European Commission's Directorate General for Employment and Social Affairs
- Rural Development: managed by the European Commission's Directorate General for Agriculture.

The first two components are open to all beneficiary countries, whereas the last three are available only to candidate countries. The reason is that the last three components are designed and operate like the structural, cohesion and rural funds available only to EU Member States. Although ICT investments are not a clear priority, they are also not excluded. As a result international cooperation between countries with a virtual accessibility perspective could be an option. At this point potential candidate countries eligible for IPA funding are: Albania, Bosnia and Herzegovina, Serbia and Kosovo. Candidate countries are Turkey and the Former Yugoslav Republic of Macedonia. Available budget, pursued policy objectives and eligible stakeholders are individual to each IPA and are a result of an agreement between the IPA countries, member states and EU authorities.

European Agricultural Fund for Rural Development (EAFRD)

A fund that can provide finances for rural development is the EAFRD. The policy priorities of the EAFRD are the following:

- The competitiveness of agriculture and forestry;
- the environment and the countryside;
- the quality of life and the management of economic activity in rural areas.

The Fund is complementary to other national, regional and local actions, which in turn

contribute to Community priorities. The strategic goals of the EAFRD are expressed in 4 policy priority axes:

- Improving the competitiveness of the agricultural and forestry sector
- improving the environment and the countryside
- quality of life in rural areas and diversification of the rural economy
- LEADER

Although ICT investments in general and broadband development in particular, are not explicitly mentioned as intended policy objectives, European experience shows that it is possible to secure funding for such purposes through the EAFRD. Specifically Italy and Austria have used funds from the EAFRD to finance broadband strategies in rural areas, thus fostering rural development and the reduction of the digital divide. For the period 2007 – 2013 the EAFRD had a budget of 96.3 billion euros, or 20% of the common agricultural policy (CAP).

UNDP and USAid Grants

Finally all countries have theoretically access to funding from the UNDP and USAid. However the preference of those organizations to lower income countries limits eligibility to the European periphery. Regarding the thematic scope both organizations have an objective to foster and assist the necessary policies that ensure and improve democratic governance through the creation of a more transparent and efficient institutions.

Loans

Definition of the term "Loan": "The act of giving money, property or other material goods to another party in exchange for future repayment of the principal amount along with interest or other finance charges. A loan may be for a specific, one-time amount or can be available as open-ended credit up to a specified ceiling amount." In practice all terms of a loan are usually defined in a contract that precedes the disbursement of funds. These terms could include legal stipulation regarding collateral, maximum interest rate to be paid, start and length of the repayment period.

Contrary to grants, the beneficiary of a loan is expected to repay the principal plus some interest. For the purposes of this report loans will be divided into two categories: Loans provided by financial institutions and loans provided through specialised funding instruments designed and financed by the EU and implemented in conjunction with local governments. Banking institutions when evaluating an investment are always guided by the same principles:

- establish economic and financial viability and
- ensure repayment of the loan.

Since uncertainty is a crucial determining factor in evaluations like this, and there is always risk of non- repayment, estimation of this risk determines approval and interest rate of each loan. However not all banks have the same attitude towards public investments. Private sector banks' motives are based on the continuous attempt to finance projects in a way that maximises profits while choosing those that have the lowest risk of default. However this attitude allows for the possibility that some investments which have significant social or wider economic value combined with uncertain financial returns might not secure funding. Should this be the case, the gap left by the private sector is covered by banks that are owned and/or operated by national governments. Prominent examples in this category are the European investment Bank (EIB), the Council of Europe Development Bank (CEB) and the World Bank Group. All those banks are owned by national governments and provide financing with preferential terms compared to private sector banks.

EIB loans for development projects in excess of €25m

The European Investment Bank (EIB) is owned by the 27 members of the European Union. Eligible countries are mostly EU Member States, however a small portion is also used to finance projects outside the EU. Among its objectives are investments that improve productivity, facilitate innovation and promote regional development. Individual projects are funded when the total investment cost exceeds EUR 25m. The purpose is to create conditions sufficient to attract other investors. Although the loans can cover up 50% of the total cost for both public and private sector promoters, but on average this share is about one-third. There is some degree of flexibility regarding the structure of the loan. For example it is possible to finance multi-component, multi annual investment programmes using a single "framework loan". In this case the loan is possible to finance a range of projects, usually by a national or local public sector body, most frequently regarding infrastructure, energy efficiency/renewables, transport and urban renovation. Although flexibility in the structure of a loan is possible, all approved projects have to adhere to the EIB lending objectives and must be economically, financially, technically and environmentally sound. The final terms of the loan can vary depending investment type and the security offered by third parties (banks or banking syndicates, other financial institutions or the parent company). In this vein the EIB provides multiple options for the interest rate, which can be fixed, revisable or convertible (i.e. allowing for a change of interest rate formula during the lifetime of a loan at predetermined periods). Additional fees are possible to be charged for project-appraisal, legal services, commitment, non-utilisation etc. Another interesting feature is the possibility for the loan to be denominated in various currencies beyond the Euro, specifically the bank can also lend in: GBP, USD, JPY, SEK, DKK, CHF, PLN, CZK and HUF as well as currencies of candidate countries and other EIB partner countries. The repayment schedule is usually semi-annual or annual, with a possibility to grant grace periods.

EIB loans via local banks

The European Investment Bank (EIB) can also lend money to local banks, which then use this money to provide loans to local stakeholders. The latter could be both from the private sector (businesses of any size) and the private sector (government administrations, both at the national and regional level). All those intermediated loans have to be in compliance with at least one of the EIB's public policy objectives: Increase in growth and employment potential; economic and social cohesion; environmental sustainability and sustainable growth. Lending decisions regarding the loan conditions (size, duration, structure etc.) are responsibilities of the intermediary institutions. The latter also bear all financial risk from the loan. This stems from the fact that the final beneficiary does not enter a contractual relationship with the EIB but only with the intermediary bank. However, since all loans must conform to the EIB policy objectives, the intermediary must transfer a financial advantage reflecting the impact the funding. It is the intermediary's responsibility to inform the end-clients about these conditions.

EIB structured finance providing additional support to priority projects

Priority projects can also receive financial help using instruments that have a higher risk profile than the instruments presented so far. These projects are in areas such as infrastructure, knowledge economy, energy and SMEs. The support is provided by the Structured Finance Facility (SFF) and the financial instruments available include: senior loans and guarantees incorporating pre-completion and early operational risk; subordinated loans and guarantees ranking ahead of shareholder subordinated debt; mezzanine finance, including high-yield debt for SMEs experiencing high-growth or are undergoing restructuring; project-related derivatives. The SFF has been very successful and the EIB has increased available funds to €3.75bn.

Competitiveness and Innovation Framework Programme (CIP)

The CIP and specifically the ICT – PSP branch have been analysed in more detail in Section 4.1.2.2. Although financing is provided mainly through grants, loans are also included in the available funding instruments.

World Bank Group

The World Bank Group was founded in 1944 is owned and managed by its 188 member countries. It consists of five institutions, however two are more active in the area of loans for infrastructure investments; the International Bank for Reconstruction and Development (IBRD) and the international Development Association (IDA). The IBRD operates mostly on middle-income but creditworthy poorer countries, while the IDA focuses exclusively on the world's poorest countries. The World Bank Group provides loans and technical assistance to countries

in more favourable terms than the private sector. Attention is given to projects that improve public services and foster transparency.

Guarantees

A loan guaranteed by a third party in the event that the borrower defaults. In the case of large infrastructure projects the loan is usually guaranteed by a government agency or a specialised financial institution (bank or insurance company). In this case the guarantor will purchase the debt from the lending financial institution and take the corresponding responsibilities. The positive effect of the guarantee is twofold. The lender has additional security that the principal and interest will be repaid in full. Therefore there is an increased incentive to proceed with financing the project. Furthermore increased security of debt repayment lowers the lending cost, since the lender is able to offer a lower interest rate. The resulting benefit, in terms of lower interest cost, in many cases outweigh the cost that the guarantor might impose through fees for the guarantee. On the other side and in cases where a government agency guarantees the loans for an infrastructure investment of social importance, there are significant social benefits to be gained through the guarantee as well. A guarantee ensures that an investment will be undertaken, while it does not impose a direct burden on the government budget. Certainly, in case of failure the government would have to pay the lenders, however it is safe to assume that not all guaranteed projects will face bankruptcy and even in such a case the government will expect to recover some of the money. Overall the result is that more investments are implemented with a lower cost for the government, given the constraints in available funds.

The primary source for guarantees for the area of interest, and maintaining the characteristic that its evaluations are not entirely base on market criteria, is the European Investment Bank (EIB). The instruments used by the EIB are the following:

- Direct Guarantees. Some projects, although very important, are not attractive to investors due to increased risk and uncertainty. For this category of projects the EIB can provide guarantees in order to make them more attractive. This tool can be used to support small and large projects.
- Through financing instruments in conjunction with the European Union and the CEB (Jeremie, Jessica, Jasmine). Detailed presentation in section 4.5.
- Through the European Investment Fund (EIF). The EIB is majority owner of the EIF. The latter specialises in innovative financial instruments for investment funding.

Another source for investment guarantees is the Competitiveness and Innovation Framework Programme (CIP).

Equity

Definition of the term "Equity": "Ownership interest or claim of a holder of common stock (ordinary shares) and some types of preferred stock (preference shares) of a company. On a balance sheet, equity represents funds contributed by the owners (stockholders) plus retained earnings or minus the accumulated losses." In an equity investment the party that provides the funds takes an ownership interest in the output of the investment. In the context of this analysis an example would be the following: A funding mechanism finances in conjunction with a national government a project in the area of virtual accessibility which takes the form of a company. In this company the stockholders are the funding mechanism and the national government.

The financing instruments that have been presented so far have significant differences. In the case of grants the grantor provides financing for a project, but does not expect repayment. Contrary to that in the case of loans the lender expects repayment of the principal with the addition of interest which depends on the agreed interest rate. Guarantees are different in the sense that the guarantor does not provide any funds immediately, but only commits to provide funds if the project faces financial difficulties. Equity investments are different. The party that provides the funds becomes also a shareholder and has a claim on a share of future profits. In line with the distinction made in the typology section we divide equity investments into two categories. Public Private Partnerships and Venture Capital Investments.

Public Private Partnership

Public private partnerships appear to be very similar to equity investments. In fact most of the PPPs are indeed equity investments of the private sector in government projects. These government projects have an expected revenue stream, on part of which has claimed the private investor in order to recover his invested funds and make profit. However PPPs are not restricted to this form. Another common example is a partnership where the private sector does not invest money, or if he/she invests money, does not take equity in return. Such projects are investments where the government involves a private partner who is in charge of building and operating the necessary infrastructure, and receives money for that directly from the government. In cases like that the private partner does not have an ownership claim over the output and revenue stream from the investment and thus cannot be classified as equity investments.

Venture Capital / Angel Investment

Venture Capital Investment definition: "An investment fund that manages money from investors seeking private equity stakes in start-up and small- and medium-size enterprises with strong

growth potential. These investments are generally characterized as high-risk/high-return opportunities."

Angel Investment Definition: "An investor who provides financial backing for small start-ups or entrepreneurs. Angel investors are usually found among an entrepreneur's family and friends. The capital they provide can be a one-time injection of seed money or ongoing support to carry the company through difficult times." Some remarks regarding venture capital investments, angel investments, equity investments and PPPs. By investing they take an ownership interest in the investment venture capital and angel investors essentially are equity investments. However this similarity can be misleading. Venture Capitalist and Angel Investors usually require a higher return on investment and a smaller cost recovery period, while accepting higher risk. This aggressive rent-seeking behaviour distinguishes them from other equity investors modifies their investment evaluation criteria. Another reason that we considered VC/Angel separately is that it is a private source of funding while PPPs are usually a combination is government/official plus private

Public Private Partnerships

Projects in virtual accessibility can be funded using PPPs. Available sources for countries in SEE are mostly the European Union Institutions.

- European Structural Funds. National governments can formulate operational plans in accordance with EU Structural Funds directives and regulations. This way they can divert funds to projects related to virtual accessibility (if eligible by the Funds' objectives) and use PPPs to finance them. At this point it is important to stress out that the EU Structural Funds do not use PPP as a form of financing. Money from the Funds is given to the Member States in the form of a grant. However the latter may choose to use these money for a PPP and in conjunction with a private sector contribution implement an investment
- Competitiveness and Innovation Framework Programme (CIP). The objectives and evaluation criteria of the CIP are presented in Section XX and Annex XX. Regarding ICT – PSP, although it uses mainly grants to finance projects, equity investments are also an available option.

Venture Capital and Angel Investors

Venture Capital and Angel Investors are a form of equity investment that specialises in high risk projects that are very promising and could result in above average returns. Both types are most commonly present in the pure private sector. However the EU official recognising possible market inefficiencies and gaps and the great potential of such investments, are using available

money to finance private venture capital firms.

- EIB and EIF. The EIB Venture Capital facility attempts to bridge the market gaps by cooperating with the financial sectors. Through the European Investment Fund (EIF) the bank finances venture capital funds and provides instruments such as subordinated loans to private financial institutions. This way venture capital and private equity fund managers can provide capital to promising SMEs that are riskier to finance. Financing decisions are the responsibility of the intermediaries and investment decisions are made based on commercial and financial criteria.
- Jeremie. This is a special funding vehicle that uses EU Structural Funds and innovative financing instruments in order to provide resources for the implementation of EU policies.

Existing Funding Frameworks in the SIVA consortium area.

In this section a short overview of the existing funding frameworks in the SIVA consortium area is provides. The purpose is to provide basic information regarding the approach chosen by countries in South-east Europe and identify if and how they are exploiting European and National resources.

Austria is currently funding Broadband development mainly under the umbrella of the "Broadband Austria 2013" (BBA 2013) program, which is financed using resources from the rural development fund. The program is designed to cover 143 rural areas and the target is to achieve high bandwidth in these areas by the end of 2013. Funds for the BBA 2013 are also drawn for some areas from the ERDF. The latter was in the past the main source of funding for broadband expansion in Austria.

Bulgaria is aiming at developing a publicly-owned broadband infrastructure that will ensure that critical communications will be secure and dependable; in order to do that Bulgaria included the planned broadband expansion in the Operational Programme "Regional Development" 2007 - 2013 (OPRD). The objective is to construct the necessary broadband connections to the urban periphery, and other rural and less urbanized areas. Under this framework the Bulgarian Government has allocated €20m that will be directed to the "Electronic communication networks and information systems" agency. This agency will be solely in charge in rolling out the targeted high speed networks in the areas of interest. Approval for this project from the EU competition authorities is pending.

In Greece ICT development is financed within the framework of the Operational Program "Digital Convergence" which is funded from the European Structural Funds. Under the umbrella of the operational program, public authorities design various activities that promote and facilitate and finance the development of an extensive broadband network. The main

programmes that are used for these purposes are the "Rural Broadband Project" and the "MANs exploitation Project". Although funding has been approved by the European Authorities, absorption rates remain low.

Italy was one of the first countries to use the European Agricultural Fund for Rural Development (EAFRD) to finance broadband investments. Italian authorities have shown exemplary inter-agency coordination towards the development of high bandwidth networks. All layers of government are involved, from regional and municipal authorities to central government ministries. Although the major source of funds is the European Budget, in order to accelerate development, local authorities are actively contributing thought their own budget allocations. The result is reflected in the positive results in terms of currently achieved population coverage, and the corresponding ambitious future planning.

Slovenia is designing investment policies using mainly funding from the European Regional Development Fund. There has been extensive effort towards the deployment of broadband networks. The preferred investment model is Public – Private Partnerships (PPP), although the possibility is also explored for purely commercial interest in areas where this is considered feasible, with initially positive responses.

4.3 References

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4.4 Abbreviations

AEK	Agency for Electronic Communications
DAE	Digital Agenda for Europe
DBO	Design, Build Operate
EAFRD	European Agricultural Fund for Rural Development
ECNIS	Electronic communication networks and information systems
ECS	Electronics Communications Sector
EIB	European Investment Bank
EPEC	European PPP Expertise Centre
FTTH	Fiber to the Home
GOCO	Government Owned, Contractor Operated
NRA	national regulatory authorities
NGA	Next Generation Access Network
OPRD	Operational Programme "Regional Development"
PPP	public-private partnerships
RSPP	Radio Spectrum Policy Programme
SGEI	service of a general economic interest

5) COMPARATIVE ANALYSIS REPORT ON THE PILOT RESULTS AND FINDINGS OF A COMMON COST REDUCTION ASSESSMENT TOOL

Produced by PED DM
Co-authors: Maša Isaković, Marko Papić

5.1 Methodology

Purpose and goal

The objective of the common cost reduction assessment tool is to enable the estimation of the expected benefits from exploiting existing infrastructures when deploying a broadband network. The analysis, derived from cost reduction assessment tool data, will result in a set of evidence *a)* on the coverage that can be achieved in the selected areas based on the deployment of the new network and the effect of exploiting existing local access and passive infrastructures and *b)* on calculations of the costs needed for expanding the broadband networks through the sharing of existing and/or common development of new infrastructures compared to the alternative, which is refraining from using existing infrastructures.

Context and scope

An easy-to-use Excel-based interface tool was developed, entitled "Common cost reduction assessment tool" with the aim of facilitating the deployment of broadband networks through the sharing of existing infrastructures. Based on evidence and scenarios from the SEE area, the common cost reduction assessment tool provides decision makers and planners a means to calculate effectively the total cost of a potential broadband deployment project for a specific area taking into account the financial benefits drawn from the utilisation and re-use of the existing broadband infrastructures.

Detailed information about the proposed network planning and a detailed account of existing broadband infrastructures are required for estimating the total cost of the investment as well as the savings to be expected through the sharing of the available infrastructures and facilities. Users have to insert such details into the tool so as to enable the estimation of the cost savings through the utilisation of existing infrastructures.

The source of this information could be an inventory of existing infrastructures such as proposed and/or already available national cadastres of telecommunication infrastructures (e.g. the Collective Cadastre of Public Economic Infrastructure in Slovenia). In case such information is available, the calculation of the total cost[1] for a proposed broadband deployment project can be disaggregated into the following stages:

- To begin with, users have to determine which type of technology (FTTH or/and wireless) the network will include.
- Users have to define the FTTH network requirements providing specific details regarding the length of the network, the distance of passing over bridges, the area type, the number of fibre optic end users, the number of ducts in trenches, the number of microducts in trenches, the number of 72-Strand Fibre Optic Cables in the trenches, the user cabling approach and the number of access nodes (indoors and cabinets). Based on this input, the tool estimates and outlines the infrastructure/equipment requirements and specifications for the construction of the proposed FTTH network.
- Users are required to define the Wireless network requirements (wireless technology, number of antennas and number of wireless end users). This information is used to generate estimates of the necessary infrastructures and outline the requirements for the construction of the wireless network.
- Users have to provide specific details about the components (ducts, microducts, microtube branching, manholes, trenches, fibre optic cables and splice enclosures) that can be utilised for the construction of the fibre optic network. Factoring in the amount of the items required to construct the network as well as their cost estimation, the tool calculates the total cost for the construction of the fibre optic network with and without the use of the existing infrastructure.
- Users must also input the existing amount of nodes. Factoring in the amount of the items and services related to nodes as well as on their cost estimation, the tool calculates the total cost of nodes with and without the use of the existing infrastructure.
- Users must provide information about the available amount of items related to the fibre optic end users (compact termination box, splices, indoor optical cabling and gigabit Ethernet UTP to optical SFP media converter). The tool calculates the total cost with and without the existing infrastructure for this category.
- Users have to insert the available amount of the items that already exist and can be utilized for the construction of the wireless network. Factoring in the amount of the items required to construct the network as well as on their cost estimation, the tool calculates the total cost for the construction of the wireless network with and without the use of the existing infrastructure.

[1] The per-unit costs are estimates provided by UoP. However partners/users are able to change them (if necessary) in order to accurately reflect local network deployment cost.

- Users are asked to select which other services are required to be included in the cost estimation for the proposed network. Such services may be precautionary services, repairing works, standby staff, measurements instruments and equipment, system maintenance and instalments documentation. Since these services do not relate to existing infrastructures, they are not used to calculate differences in the cost with and without infrastructure sharing; however they are useful for estimating the total cost for deploying a network and then calculating the (overall) expected impact from exploiting existing infrastructures.
- Finally, the overall estimation of the total cost of the proposed network as well as the breakdown cost per process category is presented. Lastly, the tool compares the costs of the proposed investment with or without the utilisation of the existing infrastructures and estimates the financial gains drawn with the reuse of the available facilities.

5.2 Comparative analysis of the findings

The SIVA partners, using the cost assessment tool, have provided case studies of proposed broadband network deployments based on actual data; in this section, the results from 5 of the collected cases will be presented; the cases refer to three countries (Greece, Bulgaria, Italy) and were submitted by the SIVA partners DAC, RAK, PED DM, BM and MOLISE. Among the collected cases there are three that refer to the deployment of a network in an urban environment (DAC, PED DM and BM) while two refer to network deployment in a rural environment (RAC and Molise). The cases submitted by the SIVA partners include networks utilising only fixed landline fibre optic networks (RAK and Molise) and a combination of landline and wireless technologies (DAC, PED DM and BM).

A general comment that can be made by inspecting the characteristics of the proposed networks is that it appears that the number of the expected end users in some cases is disproportionate to the planned investment and inconsistent to information provided by the other partners. For example PED DM proposes a wireless network component comprised of 5 antennas which is expected to provide services to 20 end users. At the same time BM proposes a wireless network component comprised of 4 antennas and 3,000 expected end users. These numbers create the impression that there is a significant divergence among the networks with regard to the efficiency of the implementation approach adopted and their impact it terms of broadband access provision. There is a variety of reasonable explanations to such divergences among network specifications. Indicatively:

- End–users may include institutional stakeholders. For example in the case of PED DM among the expected end users are public authorities, which in turn are going to provide broadband access to a significantly larger population of individual end users. As a result taking into account only the end users accessing the network directly would be

misleading by disregarding the indirect impact.

- Networks are infrastructures featuring extended periods of usability. This means that they can provide access to an (increasing) number of future end-users that are not included in the initial estimations.
- There are significant topographic differences among the regions from which the cases have been collected. This means that there can be significant differences among networks regarding the needed infrastructures and the potential impact solely due to the differences in the individual geographic characteristics.

5.3 Presentation of the Cases

DAC

Network Characteristics

The example presented from DAC involves a network with an overall length of 8.1 km. The network will be deployed in an urban environment and is expected to provide services to 100 end users. In order for the network to be deployed, it is necessary to use two ducts and 7 microducts in appropriate trenches.
The number of necessary access nodes amounts to 3 indoors and 7 in telecommunication cabinets. In order to improve the services provided to the end users, the fixed-line network will be complemented with a wireless network (Wi-Fi technology), which is expected to consist of 30 antennas and is expected to provide services to 500 end users.

An important characteristic in the proposed project is that a significant part of the infrastructure is already available for most of the categories identified in the tool (Fiber Optic Network, Nodes, Fiber Optic End Users and Wireless Network). Table 1 contains the data for the Fiber Optic Network category.

'able 1: Fiber Optic – Network (DAC)[2]

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Ducts	17,010	m	14,000	m	82%
Microducts	59,535	m	49,000	m	82%
Microtube branching	122	item	1	item	1%
Manholes	27	item	20	item	74%
Trenches	8,100	m	7,000	m	86%
Passing over bridges	0	m	0	m	n/a
Fiber Optic Cable, 72-Strand	8,910	m	0	m	0%
Fiber Optic Cable, 24-Strand	5,304	m	12,000	m	226%
Fiber Optic Cable, 4-Strand	0	m	0	m	n/a
Splice Enclosure	17	item	0	item	0%

t is apparent that only Microtube branching features significant deficiencies in available nfrastructures (only 1% of what is needed is available) while in the other categories more than 70% - 80% of the infrastructures are already available.

The situation is somewhat different in the "Nodes" infrastructure category (Table 2). Here in many equipment types, the existing infrastructures (if any) are limited. However, at the same ime, these are the infrastructures that have a relatively low acquisition cost, while for the ones with the highest cost (e.g. rooms for indoor access node and node Ethernet switches) there is already a critical mass of available infrastructures in place. For instance, the rooms for indoor access node have a cost per unit of €50.000; the existence of 3 rooms alone generates savings of €150,000. Examples like this highlight the importance of pre-existing relevant nfrastructures, and their crucial role in achieving cost reductions through infrastructure sharing. Furthermore they highlight the fact that, since it is nearly impossible to have all the necessary infrastructures already available, there are some categories of equipment that have a bigger impact on the cost calculations related to the deployment of a network; in the present setting the existence of appropriate buildings results in the most significant cost gains.

[2] A ratio larger than 100% implies that installed infrastructures/equipment exceeds the amounts necessary for the proposed project.

Table 2: "Nodes" (DAC)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cabinets for access nodes	4	item	0	item	0%
Rooms for indoor access node	3	item	3	item	100%
Optical Distribution Frames (ODF) Rack cabinets	14	item	3	item	21%
Optical Distribution Frames (ODF)	59	item	5	item	8%
Splices	1,416	item	0	item	0%
Cross-Connect (XC patchcords)	1,416	item	0	item	0%
Fiber Optic patchcords	604	item	0	item	0%
Fiber optic cable for ODF interconnection	2	item	0	item	0%
Rack cabinet 19" 39U	7	item	1	item	14%
Node Ethernet switches - 24 ports	7	item	3	item	43%
Air conditioning for indoors nodes	3	item	1	item	33%
Nodes' interior design	3	item	1	item	33%
Node UPS	3	item	3	item	100%
Node security system	3	item	1	item	33%

A completely different picture can be found in the "Fiber Optic – End User" category. As can be seen in Table 3, there is no infrastructure in place that can be exploited in the development of the new network.

Table 3: Fibre Optic – End users (DAC)

Item/Service	Amount		Available Infrastructures	
Compact termination box - 4 connectors	100	item	0	item
Splices	400	item	0	item
Indoors optical cabling	100	item	0	item
Gigabit Ethernet UTP to optical SFP Media Converter	100	item	0	item

Finally the "Wireless Network" (Table 4) infrastructures show a significant availability of equipment and infrastructures that can be used in the deployment of the new network. The already installed equipment in all categories covers at least 80% of the needs for the new

network; in many cases there is 100% coverage of future needs. Thus it is evident that significant cost savings through infrastructure sharing can be expected in this category.

Table 4: Wireless Network (DAC)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cross section mast for antennas	30	item	24	item	80%
Base station equipment cabinet	30	item	24	Item	80%
Mast for mounting end-users antennas	500	item	500	Item	100%
Cabinet for end-users active equipment	0	item	0	Item	n/a
Indoors optical cabling	18	item	18	Item	100%
Wireless 5.4GHz Base Station	24	item	24	Item	100%
Wireless Base Station (Wi-Fi) (2.4 GHz)	30	item	24	Item	80%
Wireless 5.4GHz CPE (Customer-premises equipment)	400	item	400	Item	100%
Wireless Customer-premises equipment (Wi-Fi) (2.4 GHz)	0	item	0	Item	n/a
Gigabit Ethernet UTP to optical SFP Media Converter	18	item	18	item	100%

Cost Reduction Assessment

The cost reduction assessment tool utilises the data input from the partners regarding the necessary infrastructures for a new network and estimates the expected benefits (in monetary terms) from exploiting existing infrastructures. Table 5 contains a summary of these cost estimations. It can be seen that the exploitation of existing infrastructures is expected to result in a 72% overall cost reduction (€691,869). Savings are concentrated in three categories, with Wireless Networks featuring the most significant individual gains. On the contrary, no gains are expected in the End-users category. Even though other services are not (by definition) relevant to infrastructure sharing, and thus no gains are expected in this category as a component of the total cost, they are included in order to increase the accuracy of the total estimation. Using the tool, we can also estimate the disaggregated impact in cost savings from each category. In the last column of Table 5 one can see that all categories feature a homogeneous contribution to gains from infrastructure sharing: 37% of the savings can be attributed to "Fiber Optic – Network" followed by "Wireless Network" (35%) and "Nodes" (28%).

Table 5: Costs and Benefits from infrastructure sharing (DAC)

Category	Total Cost with existing infrastructure	Total Cost without existing infrastructure	Percentage savings with existing infrastructure	Contribution to overall savings
Fiber Optic Network	68,858 €	326,447 €	78.91%	37%
Nodes	99,540 €	289,890 €	65.66%	28%
Fiber Optic End Users	41,700 €	41,700 €	0.00%	0%
Wireless Network	39,000 €	282,930 €	86.22%	35%
Other Services	15,000 €	15,000 €	0.00%	0%
TOTAL AMOUNT	264,098 €	955,967 €	72.37%	100%

RAK

Network Characteristics

The example provided by RAK involves the deployment of a network in a rural area, with an overall length of 2km, including a 50 meter section crossing a bridge, which is expected to provide broadband access to 50 end-users. The submitted plan does not include a Wireless network, and all infrastructures are confined to the expansion of the fiber optic network.

As a result, investments will be concentrated in three categories: *(a)* Fiber-optic network *(b)* Nodes, *(c)* Fiber-Optic End users.

Table 6 contains data regarding the required equipment and infrastructure for the network in the "Fiber-optic network" category. The data show that a significant portion of the necessary infrastructure and equipment are already in place, with availability ranging from 48% to 125% for several of them. Furthermore, it is worth noting that the only types of infrastructure/equipment, where there is complete absence of current availability, are "Microtube branching", "Manholes" and "Passing over bridges". However given necessary quantities and their unit prices, their impact on the overall cost is expected to be limited.

Table 6: Fiber Optic – Network (RAK)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Ducts	2,100	m	1,000	m	48%
Microducts	2,100	m	1,200	m	57%
Microtube branching	30	item		item	0%
Manholes	4	item		item	0%
Trenches	1,950	m	1,500	m	77%
Passing over bridges	50	m		m	0%
Fiber Optic Cable, 72-Strand	2,200	m	1,200	m	55%
Fiber Optic Cable, 24-Strand	2,292	m	1,200	m	52%
Fiber Optic Cable, 4-Strand	0	m		m	n/a
Splice Enclosure	4	item	5	item	125%

Contrary to the components of the fibre-optic network, a review of the availability of infrastructures related to network nodes (Table 7) reveals a very different picture. The provided data show that there are currently significant deficiencies in the available equipment compared to the projected needs. Only few types of the necessary components feature some availability, while there are several types of infrastructures/equipment with no installed capacity.

Table 7: "Nodes" (RAK)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cabinets for access nodes	1	item	1	item	100%
Rooms for indoor access node	1	item		item	0%
Optical Distribution Frames (ODF) Rack cabinets	4	item		item	0%
Optical Distribution Frames (ODF)	21	item	5	item	24%
Splices	104	item	35	item	34%
Cross-Connect (XC patchcords)	104	item	40	item	38%
Fiber Optic patchcords	76	item	15	item	20%
Fiber optic cable for ODF interconnection	2	item		item	0%
Rack cabinet 19" 39U	2	item		item	0%
Node Ethernet switches - 24 ports	4	item		item	0%
Air conditioning for indoors nodes	1	item		item	0%
Nodes' interior design	1	item		item	0%
Node UPS	1	item		item	0%
Node security system	1	item		item	0%

The picture is more balanced in the "Fiber optic – End Users" category (Table 8). There is a niform 50% availability across all types of necessary equipment, thus highlighting the possibility for significant savings.

Table 8: Fiber Optic – End Users (RAK)

Item/Service	Amount		Available Infrastructure		Percentage of available infrastructure
Compact termination box - 4 connectors	10	item	5	item	50%
Splices	40	item	20	item	50%
Indoors optical cabling	40	item	20	item	50%
Gigabit Ethernet UTP to optical SFP Media Converter	40	item	20	item	50%

Cost Reduction Assessment

The cost reduction assessment tool enables us to estimate the expected gains (in monetary terms) from utilising existing infrastructures in the deployment of the new network; a summary is provided in Table 9. From the table it is possible to discern that the main benefits from exploiting existing infrastructures can be obtained in the "Fibre Optic – Network" and the "Fibre Optic – End Users" categories. This is not unexpected, since these were also the categories that featured the best availability of relevant equipment/infrastructure. On the contrary in the network nodes category the expected gains are very limited (less than 5%), which can be attributed to the low levels of existing infrastructure. Overall the expected gains calculated through the tool amount to 26% (approx. €25,000). Disaggregating this figure (last column of the Table), it is possible to see that the greatest contribution to the savings (77%) can be attributed to the "Fibre Optic – Network" category, followed by "Fibre Optic – End Users" (13%) and "Nodes" (10%).

Table 9: Costs and Benefits from infrastructure sharing (RAK)

Category	Total Cost with existing infrastructure	Total Cost without existing infrastructure	Percentage savings with existing infrastructure	Disaggregation of savings
Fiber Optic Network	8,826.00 €	27,666.00 €	68.10%	77%
Nodes	51,547.50 €	53,885.00 €	4.34%	10%
Fiber Optic End Users	3,230.00 €	6,460.00 €	50.00%	13%
Wireless Network	0.00 €	0.00 €	0.00%	0%
Other Services	7,500.00 €	7,500.00 €	0.00%	0%
TOTAL AMOUNT	71,103.50 €	95,511.00 €	25.55%	100%

PED DM

Characteristics

The case submitted by SIVA partner PED DM refers to the development of a network in an urban environment with a total length of 10.4 km. The network is expected to provide broadband access to approximately 350 end-users. It will have both a fixed landline and a wireless component. For the landline, a dedicated 4-fiber cable per user solution has been selected as a cabling approach. The Wireless network (Wi-Fi technology) is going to consist of 5 antennas and provide services to 20 end- users. Table 10 and Table 11 provide information regarding the existing infrastructures/equipment and the respective needs for the proposed new network.

Table 10: Fibre Optic – Network (PED DM)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Ducts	21,840	m	2,300	m	11%
Microducts	21,840	m		m	0%
Microtube branching	156	item		item	0%
Manholes	52	item		item	0%
Trenches	10,400	m	2,300	m	22%
Passing over bridges	0	m		m	-
Fiber Optic Cable, 72-Strand	11,440	m		m	0%
Fiber Optic Cable, 24-Strand	0	m		m	-
Fiber Optic Cable, 8-Strand	17,000	m		m	0%
Splice Enclosure	21	item		item	0%

Table 11: "Nodes" (PED DM)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cabinets for access nodes	6	item		item	0%
Rooms for indoor access node	1	item	1	item	100%
Optical Distribution Frames (ODF) Rack cabinets	14	item		item	0%
Optical Distribution Frames (ODF)	101	item		item	0%
Splices	2,408	item		item	0%
Cross-Connect (XC patchcords)	2,408	item		item	0%
Fiber Optic patchcords	854	item		item	0%
Fiber optic cable for ODF interconnection	2	item		item	0%
Rack cabinet 19" 39U	7	item		item	0%
Node Ethernet switches - 48 ports	6	item		item	0%
Air conditioning for indoors nodes	2	item		item	0%
Nodes' interior design	1	item		item	0%
Node UPS	1	item		item	0%
Node security system	1	item		item	0%

The main characteristic of this case is that there is a very limited amount of equipment/infrastructures that are already in place and can be exploited by the new network. This is visible in the "Fibre Optic –Network" category where some of the necessary ducts and tranches are available (Table 10) and in the "Nodes" category (Table 11) where only the room for the indoor access node is available. None of the components necessary for the "Wireless Network" and the "Fibre Optic – End Users" categories are in place, resulting in the absence of potential gains from infrastructure sharing in those categories.

Table 12: Costs and Benefits of infrastructure sharing (PED DM)

Category	Total Cost with existing infrastructure	Total Cost without existing infrastructure	Percentage savings with existing infrastructure	Disaggregation of savings
Fiber Optic Network	277,204.00 €	324,814.00 €	14.66%	49%
Nodes	324,826.00 €	374,826.00 €	13.34%	51%
Fiber Optic End Users	145,950.00 €	145,950.00 €	0.00%	0%
Wireless Network	76,700.00 €	76,700.00 €	0.00%	0%
Other Services	15,000.00 €	15,000.00 €	0.00%	0%
TOTAL AMOUNT	839,680.00 €	937,290.00 €	10.41%	100%

BM

The case study submitted by BM proposes the deployment of a broadband network that is expected to have an overall length of 13.6km. The technology that has been selected is a 24-fiber cabling approach per 6 users. The objective is to provide services to 1,000 end-users in an urban environment. Additional to the fixed land-line, the proposed network includes a wireless component. The wireless network will consist of 4 antennas and is expected to provide services to 3,000 end- users.

Network Characteristics

Table 13 contains an overview of the available infrastructures compared to the requirements of the new network in the "Fibre Optics – Network" category. It can be seen that there is low availability in most of the necessary infrastructures/equipment; most of them feature an availability that is below 10%, one is between 10% - 20% (Trenches – 19%) and one above 80% (82% of the Splice Enclosures are available).

Table 13: Fiber Optic – Network (BM)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Ducts	143,042	m	3,500	m	2%
Microducts	143,042	m	2,800	m	2%
Microtube branching	205	item		item	0%
Manholes	69	item		item	0%
Trenches	13,623	m	2,600	m	19%
Passing over bridges	0	m		m	n/a
Fiber Optic Cable, 72-Strand	149,853	m	4,500	m	3%
Fiber Optic Cable, 24-Strand	31,220	m	2,600	m	8%
Fiber Optic Cable, 4-Strand	0	m		m	n/a
Splice Enclosure	28	item	23	item	82%

There is a similar picture in the "Nodes" category (Table 14). In most types of equipment/infrastructures there is zero or negligible availability in the current network. There are two with some availability and another two with installed capacity of over 60%.

Table 14: "Nodes" (BM)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cabinets for access nodes	10	item	10	item	100%
Rooms for indoor access node	10	item		item	0%
Optical Distribution Frames (ODF) Rack cabinets	60	item		item	0%
Optical Distribution Frames (ODF)	1367	item	25	item	2%
Splices	104	item	64	item	62%
Cross-Connect (XC patchcords)	104	item	25	item	24%
Fiber Optic patchcords	76	item	36	item	47%
Fiber optic cable for ODF interconnection	3	item		item	0%
Rack cabinet 19" 39U	20	item		item	0%
Node Ethernet switches - 24 ports	60	item		item	0%
Air conditioning for indoors nodes	10	item		item	0%
Nodes' interior design	10	item		item	0%
Node UPS	10	item		item	0%
Node security system	10	item		item	0%

The picture is radically different in the "Fibre optic – End Users" category (Table 15). In 3 out of 4 infrastructure categories the infrastructures/equipment already installed significantly exceed the needs of the new network. Only for one type of equipment the installed capacity is inadequate to accommodate the expected needs of the network under design.

Table 15: Fiber Optic – End Users (BM)

Item/Service	Amount		Available Infrastructure		Percentage of available infrastructure
Compact termination box - 4 connectors	10	item	25	item	250%
Splices	40	item	100	item	250%
Indoors optical cabling	40	item	97	item	243%
Gigabit Ethernet UTP to optical SFP Media Converter	40	item	4	item	10%

Finally the "Wireless Network" category (Table 16) exhibits a more balanced picture regarding the infrastructures/equipment that is already installed. There is no category with no installed capacity. Only few types feature relatively low availability, while for the majority of equipment there is a 40% - 70% capacity already installed (with respect to the expected needs).

Table 16: Wireless Network (BM)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cross section mast for antennas	4	item	1	item	25%
Base station equipment cabinet	4	item	1	item	25%
Mast for mounting end-users antennas	3,000	item	2,000	item	67%
Cabinet for end-users active equipment	3,000	item	350	item	12%
Indoors optical cabling	3,000	item	1,350	item	45%
Wireless 5.4GHz Base Station	0	item		item	n/a
Wireless Base Station (Wi-Fi) (2.4 GHz)	4	item	2	item	50%
Wireless 5.4GHz CPE (Customer-premises equipment)	0	item	0	item	n/a
Wireless Customer-premises equipment (Wi-Fi) (2.4 GHz)	3,000	item	1,200	item	40%
Gigabit Ethernet UTP to optical SFP Media Converter	3,000	item	1,300	item	43%

Cost Reduction Assessment

The gains from exploiting existing infrastructures in the deployment of the new network are going to be the lowest in the "Fibre Optic – Network" and the "Nodes" category (8.3% and 2.71% respectively). Similarly the tool calculates significant savings in the "Fibre Optic – End Users" (55.42%) and the "Wireless Network" (50.42%) categories. These results are to a great degree foreseeable, in the sense that the lowest savings are found in the categories with the lowest installed capacity.

A more interesting result that is highlighted by the tool is the importance not only of the gains in each category, but also the relative importance of each category (and by extension the respective savings) to the overall project gains. Specifically the tool reveals that the most significant infrastructure category in the proposed network is the "Wireless Network" component. Its share in the total cost of the network exceeds 70%. This fact in conjunction with the significant potential for cost saving through infrastructure sharing brought forward by the tool (50.42%), result in a relatively high cost savings ratio for the project overall. Specifically for the whole network the reduction of cost is expected to be 42.8% or €3.08 million out of which €3.017 million (98%) are due to the exploitation of existing wireless components, followed by "Fibre Optic – Network" (1%), "Nodes" (1%) and "Fibre Optic – End Users (0.1%).

Table 17: Costs and Benefits of infrastructure sharing (BM)

Category	Total Cost with existing infrastructure	Total Cost without existing infrastructure	Percentage savings with existing infrastructure	Disaggregation of savings
Fiber Optic Network	433,610.90 €	472,860.90 €	8.30%	1%
Nodes	705,127.50 €	724,805.00 €	2.71%	1%
Fiber Optic End Users	2,880.00 €	6,460.00 €	55.42%	0%
Wireless Network	2,967,050.00 €	5,984,600.00 €	50.42%	98%
Other Services	7,500.00 €	7,500.00 €	0.00%	0%
TOTAL AMOUNT	4,116,168.40 €	7,196,225.90 €	42.80%	100%

Molise

The case submitted by MOLISE describes the deployment of an FTTH broadband network in a rural area. The designs foresee the deployment of a network with an overall length of 2.5km, without bridge crossings. The expected number of end-users is 100 and the selected technology involves the sharing of a 24-fiber per 6 users. The network under design does not include a wireless component.

Network Characteristics

Data provided by MOLISE indicate that there is installed capacity in only some of the infrastructure categories identified in the cost reduction assessment tool. Specifically, following the classification in the tool, infrastructure availability is limited in the "Fibre Optic – Network" and "Nodes" categories. There is no capacity installed in the "Fibre Optic – End Users" category and in the "Wireless" category; given that there is no plans regarding a wireless component to the network, the absence of relevant equipment/infrastructures is not going to affect the present analysis.

In the "Fibre Optic – Network" category the data provided by MOLISE indicate that only two types of infrastructures feature already installed capacity (Table 18). Both types are related to passive segments of the network and the installed capacity exceeds the infrastructures necessary for the new network; no further investments will be necessary for those types of investments.

Table 18: Fibre Optic: Network (MOLISE)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Ducts	2,600	m	3,800	m	146%
Microducts	2,600	m		m	0%
Microtube branching	38	item		item	0%
Manholes	5	item		item	0%
Trenches	2,476	m	3,800	m	153%
Passing over bridges	0	m		m	n/a
Fiber Optic Cable, 72-Strand	2,724	m		m	0%
Fiber Optic Cable, 24-Strand	2,838	m		m	0%
Fiber Optic Cable, 4-Strand	0	m		m	n/a
Splice Enclosure	5	item		item	0%

Similarly to the "Fibre Optic – Network" category, the "Nodes" category has even less installed capacity. Table 19 shows that only one category features available equipment and that, although no further investments will be necessary for this type, overall these infrastructures are only a small fraction of the needs in this category.

Table 19: "Nodes" (MOLISE)

Item/Service	Amount		Available Infrastructure		Ratio of available/needed infrastructures
Cabinets for access nodes	2	item	2	item	100%
Rooms for indoor access node	2	item		item	0%
Optical Distribution Frames (ODF) Rack cabinets	8	item		item	0%
Optical Distribution Frames (ODF)	41	item		item	0%
Splices	104	item		item	0%
Cross-Connect (XC patchcords)	104	item		item	0%
Fiber Optic patchcords	76	item		item	0%
Fiber optic cable for ODF interconnection	2	item		item	0%
Rack cabinet 19" 39U	4	item		item	0%
Node Ethernet switches - 24 ports	8	item		item	0%
Air conditioning for indoors nodes	2	item		item	0%
Nodes' interior design	2	item		item	0%
Node UPS	2	item		item	0%
Node security system	2	item		item	0%

Cost Reduction Assessment

As can be expected from the characteristics of the existing network and the needs for the proposed network, the tool's estimations reveal that there are significantly more gains to be expected in the "Fibre Optic – Network" category. It reveals that almost 77% of the cost in this category can be avoided by using existing infrastructures; this is achieved through only two types of infrastructures (Ducts and Trenches). Thus the tool proves very useful in demonstrating the significant impact of some types of costly infrastructures in the overall network design and deployment. At the same time the tool reveals that there is small potential for cost savings from the "Nodes" category; only 3.27% of the cost is this category is expected to be mitigated through exploiting existing infrastructures.

Assessing the relative impact of each category in overall savings, the results are not surprising. The "Fibre Optic – Network" category has the most significant impact on overall savings; 88% of the expected cost reduction can be attributed to this category. However the tool reveals another interesting fact. Given that the "Nodes" category represents a significantly larger part of the networks overall cost (almost 70%), the overall cost reduction is relatively low (approximately 17%) while the contribution from the "Nodes" category to it is not negligible (12%).

Table 20: Costs and Benefits from infrastructure sharing (MOLISE)

Category	Total Cost with existing infrastructure	Total Cost without existing infrastructure	Percentage savings with existing infrastructure	Disaggregation of savings
Fiber Optic Network	7,854.80 €	33,654.80 €	76.66%	88%
Nodes	103,435.00 €	106,935.00 €	3.27%	12%
Fiber Optic End Users	6,460.00 €	6,460.00 €	0.00%	0%
Wireless Network	0.00 €	0.00 €	0.00%	0%
Other Services	7,500.00 €	7,500.00 €	0.00%	0%
TOTAL AMOUNT	125,249.80 €	154,549.80 €	18.96%	100%

5.4 Comparative Results

The cases submitted by the SIVA consortium partners are from 3 different countries (Greece, Italy and Bulgaria) and refer to both urban and rural environments. The insights that can be acquired by using actual data and employing the cost reduction assessment tool are very interesting. The present section will provide a summary of these insights and draw conclusions by reviewing *(a)* common characteristics in the availability of currently installed broadband infrastructure/equipment and *(b)* the calculations and results from the tool regarding the

potential for resource saving through infrastructure sharing.

The findings will highlight the fact that maximising the exploitation of existing infrastructures of any type can result in significant resource gains during the deployment of a new network. Exploitation of these gains may take several forms; it can imply the reduction of the budget necessary for a specific network deployment or, equivalently, the expansion of the new network beyond the initial plans. In both cases the results are beneficial in societal terms and may lead to the acceleration of overall service provision.

5.4.1 Availability of broadband infrastructure

This section will provide a comparative review of the availability of installed broadband infrastructure in the cases submitted by the SIVA partners. The aim is to distinguish common characteristics and provide possible explanations of why such trends might exist. At this point it is necessary to stress the fact that due to the small size of the sample (only 5 cases), conclusions and generalization of the results must be made/treated with caution; it is possible that trends and common characteristics that appear in the dataset are coincidental and do not necessarily indicate towards the existence of similar general trends. Nonetheless, keeping in mind that generalizations should be made with caution, highlighting possible trends will allow exemplifying the advantages of infrastructure sharing.

In this vein, reviewing the data used in the tool, one trend that is possible to be distinguished is that across all cases submitted there appears to be a consistency in the categories that feature already installed and available broadband infrastructures. Specifically the categories "Fiber Optic – Network" and "Nodes" consistently exhibit some infrastructures/equipment in place that can be exploited in the new network and result in deployment cost reduction. Furthermore there appears to be some consistency among the submitted cases in the types of infrastructures that are usually available.

The calculations based on data imported into the cost reduction assessment tool, for example, indicate that in the "Fibre Optic – Network" (Table 21) category the main source of resource savings is usually the existence and reusability of (costly) passive infrastructures; Ducts, Microducts and Trenches consistently exhibit an increased potential to cover the necessities of a new network while being associated with high (initial) construction costs.

Table 21: Ratio of available/needed infrastructures in the category "Fibre Optic – Network" (All Cases)[33]

Types of infrastructures	DAC	RAK	PEDDM	BM	MOLISE
Ducts	82%	48%	11%	2%	146%
Microducts	82%	57%	0%	2%	0%
Microtube branching	1%	0%	0%	0%	0%
Manholes	74%	0%	0%	0%	0%
Trenches	86%	77%	22%	19%	153%
Passing over bridges	-	0%	-		-
Fiber Optic Cable, 72-Strand	0%	55%	0%	3%	0%
Fiber Optic Cable, 24-Strand	226%	52%	-	8%	0%
Fiber Optic Cable, 4-Strand	-	-	0%	-	-
Splice Enclosure	0%	125%	0%	82%	0%

Similarly in the "Nodes" category the tool reveals that the most common infrastructures that are available and can be used in networks under deployment are the specialised rooms and cabinets that house the necessary equipment. Given their large cost, they have a significant impact on overall cost estimations and can contribute significantly in the reduction of overall cost. For example DAC and PED DM that do not necessitate the acquisition/construction of "rooms for indoor access nodes" (Table 22) achieve (to a great degree due to this fact) significant cost savings (66% and 13% respectively – Table 23) in this category.

Table 22: Ratio of available/needed infrastructures in the category "Nodes" (All Cases)

Category 2: Nodes	DAC	RAK	PEDDM	BM	MOLISE
Cabinets for access nodes	0%	100%	0%	100%	100%
Rooms for indoor access node	100%	0%	100%	0%	0%
Optical Distribution Frames (ODF) Rack cabinets	21%	0%	0%	0%	0%
Optical Distribution Frames (ODF)	8%	24%	0%	2%	0%
Splices	0%	34%	0%	62%	0%
Cross-Connect (XC patchcords)	0%	38%	0%	24%	0%
Fiber Optic patchcords	0%	20%	0%	47%	0%
Fiber optic cable for ODF interconnection	0%	0%	0%	0%	0%
Rack cabinet 19" 39U	14%	0%	0%	0%	0%
Node Ethernet switches - 24 ports	43%	0%	0%	0%	0%
Air conditioning for indoors nodes	33%	0%	0%	0%	0%
Nodes' interior design	33%	0%	0%	0%	0%
Node UPS	100%	0%	0%	0%	0%
Node security system	33%	0%	0%	0%	0%

Although in some cases the data reveal trends like the one discussed above, in the other

[3] A ratio larger than 100% implies that installed infrastructures/equipment exceeds the amounts necessary for the proposed project.

categories the results are less straightforward. For example, in the wireless components of the network, the data collected through the partners exhibit significant deviations both in stated objectives and current infrastructure availability; DAC features only small needs in new equipment, BM has a rather uniform availability across different types of equipment, while PED DM features a complete absence of the necessary infrastructures. Therefore although the tool reveals that whenever relevant infrastructures are in place, the potential for saving is very big (e.g. DAC and BM), it is very hard to identify trends and common characteristics that could lead us to valid conclusions. It is however possible to provide information based on the general cost assumptions adopted by the tool. Using this approach, in conjunction with the data included in the example submitted by DAC, it is possible to identify the "cross section mast for antennas", the "base station equipment cabinet", the "wireless 5.4GHz base station" and the "wireless 5.4GHz CPE" as the most influential infrastructures/equipment related to the wireless component of a network, due to the combination of quantities needed and unit prices. As a result, in this case the tool guides us towards the conclusion that it is possible to achieve cost saving when deploying a new network by ensuring that such infrastructures are utilized whenever they are available. This is the case in the example submitted by DAC, where cost savings in the wireless network reach an impressive 86%.

5.4.2 The potential to achieve cost reduction in broadband deployment

One of the central arguments that can be extracted from the results produced by the tool is that not all categories appear to have the same potential for achieving economic benefits through infrastructure sharing. Although there are significant differences among the examples provided by the partners, it seems that the categories where significant benefits can arise are usually the "Fiber Optic –Network" and the "Wireless Networks". These two categories are followed closely by the "Nodes" category. Differences in the relevance of each category depend on and reflect the choices of the responsible authorities when designing a new network. In this vein the calculations from the cost reduction assessment tool show that all partners expect measurable savings from exploiting existing infrastructures in the "Fibre optic network" category. Especially in the cases of RAK, PED DM and MOLISE the tool reveals that this is the category with the highest expected gains (Table 23), while for DAC it is the second highest (following closely the gains in the wireless network category). Factoring in the overall cost of each network, Table 24 (and Figure 11) reveals that the contribution of this category of infrastructure components to cost reduction is consistently significant (with BM being the only exception).

Similarly in the case of "Wireless Network" component, out of the three case studies featuring a wireless component, DAC and BM are expecting significant savings in this category by exploiting already installed equipment/infrastructures (Table 23). Furthermore the tool reveals that these

savings are, at the same time, having a significantly positive effect on the overall cost of the new network. Specifically Table 24 shows that 35% (DAC) and 98% (BM) of the cost reduction potential calculated by the tool is a result of the exploitation of existing "Wireless Network" components.

Finally the tool shows that the "nodes" category can also be a source of significant savings in resources for DAC and PED DM (Table 23). It is noteworthy that this is not the same for RAK and MOLISE (which are the cases of a network deployed in a rural environment[4]) and BM (where there is limited installed capacity).

Separating it from the others, the tool shows that RAK features significant gains in the "Fibre Optic – End Users" category. Specifically Table 23 show that RAK is expecting to have a cost savings effect reaching 50% in this category though utilizing existing infrastructures in the "Fibre optic – end users" category. This translates in 13% of the total savings in the proposed network coming from this category (Table 24). Given that RAK is the only example featuring these gains, while (at the same time) being the only example of network deployment in a rural area, it would be possible to claim that there is a causal link between these characteristics. However, as already argued in the previous section, given the small sample it would be difficult to credibly support and substantiate such a conclusion. It is possible that this effect in the "Fibre optics –end users" category is due to case specific characteristics, thus preventing generalizations. In support of this line of reasoning, it is possible to argue that the proposition that this effect is case specific is the most probable explanation: It is counterintuitive to attribute the gains in the end users segment of the network to the fact that it is deployed in a rural area, given that it is more probable that the end user segments are generally more developed in a high population density urban environment than in a topographically challenging low population-density rural area.

Table 23: Percentage of estimated savings for each category through using existing infrastructures

Category	DAC	RAK	PEDDM	BM	MOLISE
Fiber Optic Network	79%	68%	15%	8.3%	76.66%
Nodes	66%	4%	13%	2.71%	3.27%
Fiber Optic End Users	0%	50%	0%	55.42%	0%
Wireless Network	86%	0%	0%	50.42%	0%
Other Services	0%	0%	0%	0.00%	0%
Overall	72%	26%	10%	42.8%	18.96%

[4] Given the small size of the dataset it is not safe to draw conclusions on whether this is due to this fact (that it is a rural area) or due to other case specific characteristics.

Table 24: Disaggregation of the overall savings from exploiting existing infrastructures

Category	DAC	RAK	PEDDM	BM	MOLISE
Fiber Optic Network	37%	77%	49%	1%	88%
Nodes	28%	10%	51%	1%	12%
Fiber Optic End Users	0%	13%	0%	0%	0%
Wireless Network	35%	0%	0%	98%	0%
Other Services	0%	0%	0%	0%	0%
TOTAL AMOUNT	100%	100%	100%	100%	100%

5.5 Policy recommendations

The objective of this section is to provide guidelines towards achieving cost reduction in broadband network deployment through proposing common approaches on mapping existing infrastructures and increasing their availability to other operators. More specifically, this report will put forward common policy processes and suggested measures to:

- Integrate infrastructure mapping and availability prerequisites in network deployment and civil engineering construction works, and
- Maximize the use and sharing of available physical infrastructures in broadband network deployment for SEE areas.

5.5.1 Problem description

According to the SEE Transnational Cooperation Programme, a serious digital gap is quite evident in terms of telecommunication services and infrastructures between the EU as a whole and South East Europe as an independent area of interest. Notably, South East Europe demonstrates on average a number of 154 internet users per 1000 people, while the EU figure is more than double. Further more, a heterogeneous diffusion of broadband connections is also evident among countries of South East Europe as well as between urban and rural areas within the same territories; this heterogeneous coverage stems mainly from the fact that market mechanisms fail to address adequately the low population density and rural and remote areas.

The reuse of existing physical infrastructures can diminish the capital investments costs for broadband network deployment. It is estimated that around 80% of the costs of deploying new fixed infrastructure are civil engineering costs (i.e. trenching or digging) which can be

significantly reduced through proper coordination[5] between national, regional and local authorities, using town planning rules and remedies mandating access to passive infrastructures. Wireless infrastructure costs can similarly be reduced by such measures. Diminishing this cost removes an important barrier and is associated with a significant and positive effect on the economic viability of new and existing broadband networks.

The SIVA project sets forward a common approach for mapping existing infrastructures and provides policy recommendations aiming to integrate infrastructure mapping availability in network deployment plans so as to maximize the utilization and sharing of existing physical infrastructures.

The SIVA Consortium wishes *a)* to integrate infrastructure mapping and availability prerequisites in network deployment and *b)* to maximize the use and sharing of available physical infrastructures in broadband network deployment for SEE areas. Thus, this section provides some general principles and recommendations that policy makers and national authorities of the SEE area should embrace in their efforts to diminish deployment costs.

The policy recommendations are as follows:

- National authorities should increase efforts to limit the complexity of the planning-to-implementation process in regards to the cadastre. One of the most important steps is to determine procedures, obtain approvals and secure rights of way at an initial stage. Configuring the planning process is of critical importance in order to confront the delays that may arise because of the complexity of the administrative processes, the bureaucracy as wll as the great number of various levels of government and public bodies involved in the implementation of the measure.

- The broadband technology evolution involves significant financial investments in civil works and new technologies (e.g. fibre optics, wireless technologies, etc.). National governments should operate in that direction by stimulating the start-up of local companies for urban wiring facilitating the synergies with other "network" services (gas, electricity, etc.). The multi-utility company can be the owner of the broadband network working in joint venture with a National or Regional operator, and facilitating the usage of civil infrastructures and pipelines of other networks (electricity, gas, water supply, traffic light network, public lighting, etc.) to allow easy construction of fixed or mobile broadband networks.

- As regards the sharing of infrastructures, the authorization of a central body to

[5] This result is also reached through the calculations of the common cost reduction assessment tool of the SIVA project.

manage rights of way and administrative procedures will have a positive impact on the administrative burden faced by operators and any infrastructure provider planning civil works. A new or existing organization could offer a range of services including *a)* the provision of information to interested parties; *b)* the forward of wayleave applications from the operator to the infrastructure owner; c) the distribution of building permits and d) the negotiations between the stakeholders.

- Even though the general economic climate in SEE does not encourage investments using public resources, the short-term cost of the cadastre development should not postpone efforts given that the expected benefits in growth and broadband coverage are numerous and manifold. It is advisable for national authorities to commence due diligence and develop a financial feasibility study for identifying inter alias possible funding sources. As the allocation of public resources may be hampered by strict national budgets and austerity, national authorities should investigate additional financing in the funding opportunities provided by the EU and more especially in the context of financial instruments for broadband support.

- Public-private partnerships should be encouraged as a means for raising additional financing or as an alternative funding scheme. This is why the private sector is expected to be heavily involved in the provision and operation of physical infrastructures and broadband facilities. Apart from providing information in cases where private companies own existing passive infrastructures, the private sector could contribute to the financing of such a measure aiming at exploiting the investment opportunities that the mapping and sharing of infrastructures will bring to the forefront.

- National authorities should determine the legal and regulatory framework conditions with a view to the provision and access to the sensitive infrastructure data. High resolution infrastructure data and sensitive company details pose high confidentiality requirements. As a result, special care should be given to defining what type of data will be provisioned, how information will be acquired and maintained, when and under what circumstances confidentiality will be maintained and any other reasonably anticipated risk associated with the inappropriate disclosure of data.

- National regulatory authorities should adopt provisions and regulations that oblige owners of physical infrastructures, who may be unwilling to participate, to supply the necessary infrastructure details in the cadastre for the telecommunications infrastructure and to open up their facilities enabling the sharing of infrastructures.

- National authorities should communicate the potential of infrastructure sharing as well as the opportunities arisen for commercial synergies to stakeholders and interested parties.

- The creation of the cadastre of telecommunications infrastructure as well as the sharing of infrastructures will require staff with significant expertise in the field to ensure that the final outcome will meet the needs and requirements of national authorities. Hence, apart from the engagement of external experts, staff of all government levels and public bodies involved in the procedure of mapping need to be trained on the necessary concepts and details in order to facilitate the process of collecting the necessary details from the owners as well as to incorporate them into the system.

5.6 Abbreviations

FTTH	Fiber-To-The-Home
UTP	Unshielded Twisted Pair
SFP	Small Form-Factor Pluggable
SEE	South East Europe
SIVA	South East Europe improved virtual accessibility through joint initiatives facilitating the rollout of broadband network.

6) THE COMMON TRANSNATIONAL BENCHMARKING SYSTEM

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6.1 Methodology

The complete common transnational benchmarking system consists of two main elements. The first step is determining the quality of experience of citizens on virtual accessibility with the help of the quality assessment tool[1] developed by the University of Ljubljana (UL). The second step consists of importing and analysing the collected data with the SIVA planning tool[2] developed by the Technical University of Vienna (TUV).

Project partners MOLISE, KYUSTENDIL, BURGAS, DAC, and TECLA participated in the testing of both tools in the following selected application areas: Region of Western Macedonia (Greece), Region of Crete (Greece), Region of Molise (Italy), Region of Basilicata (Italy), Region of Kyustendil (Bulgaria) and City of Burgas (Bulgaria).

"SIVA Quality assessment tool"

Purpose and goal

The quality of user experience of internet accessibility is affected by many factors such as end devices, device hardware and software, connection, gateway, services, and the seamless flow between all of them. All of these factors should work seamlessly together to facilitate a positive user experience. The entire Internet infrastructure should be built to provide the best possible user experience with the given resources, it should be sensitive to the social, economic and cultural situations of the users, and it should address issues such as what is the perceived reliability and trust in services among the target users.

In order to have a clearer picture of the quality of experience of Internet access in the SEE Areas, a questionnaire has been provided through the quality assessment tool. The results of

[1] http://dev.odklopljen.si/
[2] https://tool.siva-project.eu

this questionnaire have been collected and have helped conceptualize the following:

- A comparison analysis on the Internet accessibility user experience through the SEE Areas highlighting similarities and differences, in order to understand the user satisfaction level accessing Internet and the market penetration, despite the significant Network infrastructure investments.
- Taking into account what the user experience is and the elements affecting it, a series of suggestions in a form of policy recommendations were carried out, trying to remove blocks to new market entry expansion and promote investments, policies and practices to encourage lower cost structure for industry.

Context and scope

User experience is a term that describes a user's feelings towards a specific technology, system, or object during and after they interact with it. Various aspects influence the feelings, such as the user's expectations, the conditions in which the interaction takes place, and the system's ability to serve the user's current needs.

By the time the user starts to use internet, they have certain expectations of it. If the expectations are high, user experience may be poor even if the system is performing well. On the other hand, people also evaluate the positive effects they experienced with the Internet which may overpower the possible difficulties and thereby make the user experience positive. So, even if the Internet system is not performing perfectly, it does not mean that the user experience has to be poor.
The three main elements that affect the user experience are the user's internal state, the context of use, and the actual Internet system. The Internet system, in turn, consists of three main components in the case of Internet Access: the device, the network, and finally the services available through the Internet. All these system components may come from different parties, making it challenging to provide a seamless user experience.

Three main aspects have been identified to improve the quality of experience in Internet accessibility:

- understanding the users and different uses of the Internet
- improving spectrum allocation
- improving infrastructures such as connectivity in not-served areas, network pricing policies, infrastructure sharing

Understanding these interlinked factors will allow SEE Areas to carve a path to affordability that focuses on eliminating current market or regulatory barriers, while at the same time implementing a framework for progress.

"SIVA Planning tool"

Purpose and goal

Facilitated by the geographic information systems (GIS) and geo-spatial analysis tools the technology assessment tool has been developed to allow regional authorities to map and visualise societal, geophysical and technical evidence in support of investment strategies and decision making for optimal broadband deployment and network infrastructure planning. Consequently, the technology assessment tool aims to act as an enabler for the roll out of broadband networks by improving effectiveness in the selection and deployment of optimal technologies and networks infrastructures and speeding up the decision making process.

Context and scope

The web-based interface tool, entitled "SIVA Planning tool" was developed as a means to facilitate the decision making process for the deployment of broadband networks by identifying the areas with unmet demand for broadband and by demonstrating the optimal technology to be used.

The SIVA planning tool constitutes a "tool of knowledge" for effectively identifying areas where the development of broadband infrastructure and facilities is required in order to satisfy the unmet demand for Internet services and broadband. Building upon the evidence and data of the SIVA quality assessment tool, the SIVA planning tool provides essential estimations about the deployment of broadband networks in SEE areas enhancing the decision making process and facilitating the optimisation of available economic resources through the selection of the most effective investment strategies. This is why it provides directions towards where the network infrastructure planning should proceed and what type of technology should be used so as to fit with the specialities of the area under investigation and to optimise the investment planning.

Overall, the SIVA planning tool is very simple to use as it has been designed upon computation models which are easy to handle and understand by the user. The application has a user-friendly interface and the access to the tool is allowed only to authorised users.
The SIVA planning tool allows users to explore the map using one of the following parameters (layers):

- Population density,
- Quality of service,
- Unmet demand for broadband,
- Currently used technologies.

The exploration of such layers enables users to identify areas where an unmet demand prevails and where the infrastructure planning should proceed. The online tool offers a critical function which allows users to define a specific area on the map in order to estimate the parameters relevant for planning based on its specificities (population density, quality of service, unmet demand for broadband and currently used technologies). The parameters are automatically computed and presented. Users have the possibility to adjust the settings of planning (technology to be used and cost of technology) and make new estimations as necessary. With the SIVA planning tool, users (public authorities and planners) can get an insight into the special characteristics of the area (site area and population), identify which technology is the most appropriate and receive reliable estimations about the potential investment cost. Hence, enabling public authorities to accelerate the decision making process and design more effective broadband policies.

6.2 Comparative analysis of the results

A concise version of the results is presented with a highlighted, when and where possible, comparison on similarities and differences through SEE Areas. These topics will be the starting point for the final policy recommendation.

- Overall Results:
  - Analysis: The answers collected from the businesses indicate that they are mostly dissatisfied with their current Internet connection and the majority would like to have access to better service. While the results for private residents show, that they are mostly satisfied, but would like to have access to better services anyway.
  - Consideration: The analysis above can lead to roughly outline possible actions in terms of market and investments prospective to be defined firstly to improve the perception of the Internet connection for businesses, from which then originating best conditions for private residents as well.
- FYROM:
  - Analysis: People are satisfied with the current Internet service, even if a faster Internet connection with a considerable speed is highly desired and with no willingness to pay more than the amount they currently pay for their service.
  - Consideration: If a faster service is going to be provided, the cost for the user needs to be similar to the previous one.
- Greece:
  - Analysis: People are quite satisfied with the current Internet service. A faster Internet connection without such a considerable increase in speed is highly desired and users are willing to pay more than current service.

- Consideration: There is a willingness to pay more for better service, but not specifically based only on faster speeds.

- Bulgaria:
  - Analysis: People are satisfied with their current Internet service, even if a faster Internet connection is highly desired with the best possible speed.
  - Consideration: A faster internet service is required.
- Italy:
  - Analysis: People are quite satisfied with the current Internet service and a faster Internet connection is not desired. If there would be a faster service, it should be with the best possible speed, but the users are not willing to not pay more than they pay for their current service.
  - Consideration: There are no requirements to realize a faster service. In case it will be done anyway (i.e. for technology processes reasons), this should be based on a faster speed with no increments in the cost for the users.

As a general consensus devised from the previous considerations, high-speed networks and services at affordable prices look essential for future investments and for ensuring a better quality of life for the inhabitants.

6.3 Recommendations

"SIVA Quality assessment tool"

In order to promote investment and competition in high-speed networks and services, the policy recommendations provided in this section reflect what are believed to be the most effective approaches to improve Internet access quality, according to the findings, and this together with additional technical references, research and analysis of case studies have enforced the evidence base.

Policies and best practices should promote high-speed broadband Internet at affordable prices to users and promote investment to attain the greatest geographical coverage of broadband Internet. They should also promote an optimal level of investment by creating demand for high-speed broadband networks and services, in particular in areas where governments play a key role such as in education, health, energy distribution and transport. Public policies should help foster a diversity of content, platforms, applications, online services, and other user communication tools that will create demand for networks and services, as well as allow users to fully benefit from those networks and services and to access a diversity of content.

On this basis, the policy recommendations are divided into three categories:

- understanding the users and usage of the Internet

- improving spectrum allocation
- improving infrastructures such as connectivity in not-served areas, network pricing policies, infrastructure sharing

Together these policies will encourage private-sector investment and leave the public sector to focus on infrastructure investments that otherwise would not be made, while ensuring that these investments are made as efficiently as possible.

Understanding the users and usage of the internet

The most important factor in increasing consumer behavioural intention to use Internet services was attitude, followed by perceived ease of use, perceived costs and perceived usefulness. Innovative people have a more positive perception of usefulness and are more likely to start using advanced services. Social factors have an important influence on people's decision to adopt advanced services. Furthermore, familiarity with the network technology and user skills have an impact on the perceptions of the service. The tolerance of service imperfections decreases with network technology familiarity, i.e. people who are familiar with networks and devices are more demanding of the service.

The importance of enhancing the technology skills of the general public and potential service users then becomes evident. Skills can be enhanced by tutoring workshops, easily accessible user aids and providing user guidance in situations where new services are purchased.
In addition to the consumer segment, a remarkable but perhaps an undervalued user group is the segment of work- or business-related service users. Internet access designed specifically for certain work practices may advance the functioning of entire business networks. Thus work-related access should be seen as an essential part of the development of Internet networks. For example, health care, the construction business, and logistics are fields where Internet connectivity is a crucial part of the work. In work-related situations, loss of data, mistakes in input of business information and general difficulties in interaction with the service may occur. These issues can cause intense frustration in service usage for the individuals and economic losses for the user's company. Thus, context-sensitive design is required throughout the business value chain to support internet access development.

Another point that should be highlighted in this context is the public participation. The quality of experience of Internet access will be better satisfied if user opinions and suggestions would be incorporated in the processes of technology development. This can be done through periodic consultations, questionnaires, on demand questions on specific arguments as prices, rates, speeds and alike.

According to those concepts and in order to recommend a policy to further develop this main point, the following steps have been defined:

- Understanding the user and usages of the Internet
  - Analysing Internet market development
  - Evaluation of the user acceptance of Internet service according to the context of use (business or private)
  - Enhancing the technology skills of the general public and potential service sers
  - Developing Internet access in a context-sensitive design/architecture
  - Promoting evidence-based service and processes that include public participation
  - Consulting users on pricing, speed, adoption rates, peering
  - Collection and disaggregation (such as by gender) of usage statistics to identify gaps and opportunities

Improving spectrum allocation

The availability of spectrum for broadband is critical. Regulators across all regions must take steps to establish clear policy and plans that support expansion of broadband networks and reduce the costs associated with market entry. Spectrum policy and regulation must be forward-looking and provide the opportunity with investment while also encouraging innovation. For certain bands that support broadband network service (including 700 and 800 MHz bands), regulators can consider making available the spectrum at lower or no cost, but with the appropriate obligations for investment in infrastructure an roll out of services, especially in rural areas and with affordable prices.
So, if a government communications system does not require spectrum at specific times, that spectrum can be freed up for commercial purposes during those times. With this dynamic sharing, multiple users, including federal and commercial entities, can share available bands of radio spectrum and help increase the availability of a precious resource.

So far, there is a range of technology options that allow reuse of spectrum without hurting the primary license holder, including smart or "cognitive" radios and tolerant coding, smart antennas that reduce interference. This innovation is particularly needed in rural areas, but also for continued innovation along the lines of Wi-Fi and other novel solutions.

According to that, innovative players can take advantage of unused or lightly used spectrum to deliver affordable Internet connectivity without causing interference. Regulators can designate bands of spectrum as free from licenses, which allows for innovation, a necessary condition to ensure that the industry is focusing on low cost solutions to provide services to all users. A set of new devices can be produced working on this spectrum to provide rural access to broadband or provide communication amongst devices that help monitor congestions, improve healthcare patient tracking or track energy use. For regulators, promoting unlicensed use is a low risk proposition considering the context of benefits to Internet access.

According to those concepts and in order to recommend a policy to further develop this main point, the following steps have been defined:

- Effective spectrum management
- Ensure availability and efficient use of broadband-capable spectrum
- Open, transparent, and fair allocation and licensing mechanism
- Harmonization of spectrum to global standards
- Technology and service neutral licensing allowing flexible use
- Enabling innovative usage through unlicensed spectrum and opportunistic reuse within rules that avoid harmful interference
- Transparent and fair rules for participation

Improving infrastructure such as connectivity in not-served areas, network pricing policies, infrastructure sharing

As a common purpose, operators serve high-end broadband customers in urban areas quite well. Despite the strong requirements of the Digital Agenda for Europe (DAE), investments in infrastructure are not taking place fast enough to connect rural, remote and peri-urban areas. Demand is weak due to limited disposable income and limited relevant content. In addition, competition is limited, giving network operators little incentive to invest in new markets. These mechanisms reinforce one another, creating a barrier by further limiting demand and discouraging new market entrants. Through subsides and market incentives, governments play a key role in securing the benefits of infrastructure investment in no-commercially attractive areas while at the same time addressing the socio-economic barriers that prevent the market from achieving scale.
Such initiatives should subsidize infrastructure that will reduce costs and increase digital education, promote local and relevant content development. So affordable access will drive demand for these services, in turn driving additional investment from private sector players seeking to expand mobile broadband markets and unlock related opportunities.

In order to promote maximum investment in infrastructure and service provision in those areas, all taxes, bureaucracy and cost of rights of way blocks should be assessed and minimized or removed. This specifically refers to permissions, including environmental and social, and coordination with other utilities. The parties responsible for administrating these permissions usually are not permitted to charge commercial terms and are limited in their power to refuse permission. Taxes affecting the cost of equipment needed to provide services, such as routers, smartphones and Internet access services themselves should be reduced as well.
This suggest a need for policies and regulations that lower investment risk and cost structure for industry while creating an enabling environment, with clear incentives and increased regulatory certainty.

Furthermore, infrastructure sharing should be incentivized. Governments should make it a priority to maximize private investment, both to increase competition in targeted areas and to extend infrastructure to unserved areas. Indeed, policy makers and regulators can lower investment risk and cost structures for industry by facilitating resource sharing across network operators and other infrastructure providers as well as by creating public-private partnerships (PPPs) to subsidize infrastructures projects. Many countries in the early stages of network development use PPPs to develop and operate a network while sharing the risks and rewards between public and private sector partners. PPPs can reduce capital risk for network operators and reduce operational risk for government.

Open access policies like co-location requirements, local loop unbundling, bit stream access are strongly correlated with low cost Internet access. This can lead to improved competition by ensuring that new market entrants can connect to existing networks instead of absorbing the costs of building their own infrastructure.
According to those concepts and in order to recommend a policy to further develop this main point, the following steps have been defined:

- Nurture healthy market competition:
  - Streamlined licensing process with no legal barriers for market entry
  - Ensuring a competitive market structure, with limited or no national government ownership of end user service providers
  - Transparent disclosure of pricing and service options to end users

- Streamlined processes for infrastructure deployment and sharing
  - Efficient and effective access to public rights of way and tower zoning
  - Coordinated with other infrastructure projects (fibre or duct laid during road works)
  - Facilitate sharing of backbone, ducting, right of way, and cell tower passive infrastructure
  - Target public infrastructure investment to market failures, through consultation with market players and other stakeholders. Ensure that subsidized infrastructure is competitively and transparently procured and offers access or capacity to all market players in a non-discriminatory way, so as to achieve end user affordability

- No luxury taxation or excessive customs/tariffs on telecom goods and services required for internet access
  - Including handsets, set-top boxes, data/voice service, and infrastructure equipment
  - Tax rate at comparable level to basic goods and services rather than luxury goods.

"SIVA Planning tool"

Recommendations for the utilisation of the SIVA Planning tool

- Perform an in-depth analysis of the national legal framework related to data security and protection. The insights obtained from the analysis will allow considering whether the existing framework meets the requirements for the provision and use of high sensitive data by the tool.

- Special attention should be given on access right issues. National authorities need to determine who will be authorised to use the tool and who will have the permission to access the inventory of information besides public authorities.

- Facilitate the utilisation of the tool in decision making process by speeding up related bureaucratic procedures.

- Develop collaborations with research organisations and experts / consultants, who possess significant expertise in the field of geographic information systems (GIS) as well as in the technical coordination of broadband network deployment plans, to provide guidance and support to national and regional authorities on the SIVA planning tool.

- Extend the collaboration with TUV, which is the developer of the SIVA Planning tool, beyond the lifecycle of the project in order to preserve the proper functionality and compatibility of the tool, further fine-tune its operation, and guarantee that the data imported by national authorities meet the technical specifications.

- Inform stakeholders from public authorities and interested parties about the potential of the SIVA Planning tool in supporting broadband deployment decisions. In that context, national authorities should:
  - Communicate the results of the pilot operation period among national and regional authorities in SEE and present cases where the online tool supports broadband deployment decisions.
  - Participate in collaborative events to disseminate the SIVA Planning tool for clusters of broadband projects. Stakeholders are more likely to attend a meeting presenting various thematic areas related to broadband deployment than a one single session event.
  - Organise seminars, information days and workshops to introduce the SIVA Planning tool to relevant stakeholders. Experts could train executives of public authorities on how to use the various services of the tool and how to integrate the results drawn in decision making process.

- Ensure the engagement of a broad range of stakeholders to the further development of the tool so as to accommodate emerging needs arisen within the decision making process.

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7) DATA SHARING AND AGGREGATION OF EXISTING PHYSICAL INFRASTRUCTURES FOR A COMMON INVENTORY COVERING SELECTED SEE AREAS

Produced by MOLISE
Co-authors: Maša Isaković, Marko Papić

7.1 Cadastre of telecommunications infrastructures

The Cadastre of telecommunications infrastructures is an inventory of all systems operating in the national telecommunications sector, with the main objective to define the consistency of fixed and mobile telecommunications network in a way that is fully compatible and integrated with the Cadastre of lands and buildings, with the Cadastre of national roads and with a map of underground utilities in the national area (pipelines utilized for transport of gas, public lighting, water). The technology evolution of Broadband involves significant financial investments in civil works and construction of new telecommunication equipment like fibre, tower, etc. In this context, the design of the infrastructure cadastre is acting as an essential "tool of knowledge" to allow the optimization of economic resources reducing the replication and under-utilization of existing networks, as well as to perform an accurate and regular monitoring of the Digital Divide.

National government should operate in that direction by stimulating the start-up of local companies for urban wiring facilitating the synergies with other "network" services owned in urban areas (gas, electricity, etc.). The multi-utility company could be the main actor of the TLC urban project, working in joint venture with National or Regional operator, and facilitating the usage of civil infrastructures and pipelines of other network (electricity, gas, water supply, traffic light network, public lighting, etc.) to allow easily construction of the fixed and mobile network. The infrastructure Cadastre is a complex project with several difficulties that need to be overcome: issues related to census of data, the application method to request the information, management of the cadastre, synergies with other existing Cadastres, all the needs related to a deep developing and rapid changing sector. The new Directive of the European Commission (140/2009/CE) which should have already been transposed by the nations, points out to national regulatory authorities, the possibility to impose the requirement of infrastructure sharing. Therefore, it is assumed that there is a thorough understanding of the

physical infrastructure to allow a better use of them and reduce costs for the development of broadband and ultra-wide band. In the granting of rights of way and infrastructure sharing, The European Commission has already published in the 2002 several directives, subsequently replaced by directive (140/2009/CE), aim to promotion of competition in the provision of electronic communications networks, services and related resources, encouraging efficient investment in infrastructure and promoting innovation (refer to directives 2002/21/CE (Framework Directive), 2002/77/CE (Competition Directive), 2002/20/CE (Permissions Directive), etc.).

7.2 Comparison analysis

In order to define the appropriate methodology for the realization of Cadastre of Network Infrastructures it is important to understand the current situation and future plan in terms of legislation and technical aspects in the different countries of the SIVA project partners. For that purpose a specific questionnaire was produced and sent to the partners. Based on the answers of the questionnaire, the following paragraphs summarize the most important information for each country, highlighting the reference entities, the basic provisions and the work in progress towards the implementation of such Cadastre.

It should be noted that just two of the analysed countries already have in place a register of infrastructure, although it is not completed yet and there is not a well-defined regulations, but all nations are working on legal and technical aspects to start the implementation as soon as possible.

Bulgaria

In Bulgaria the Cadastre of Telecommunication infrastructures has not been implemented yet. However there is an agency, named Geodesy, Cartography and Cadastre Agency (GCCA)[1], which manages all the activities related to the Cadastre, the Property Registration, the Geodesy and the Cartography for the whole territory of the country. This is an executive agency to the Ministery of Regional Development and Public Works. The Agency is a legal entity, having its seat in Sofia and operating through its 28 regional units – Geodesy, Cartography and Cadastre Offices, located in the administrative centres of the regions. GCCA collects, creates, maintains and stores data of the following sectors: Real estate market, Territorial and organizational planning, Infrastructure, Environment preservation. The GCCA has realized a Geografund portal to allow the clients to search and download easily, according to their permission, the information of interest.

[1] http://www.cadastre.bg/en/about-us

In Order to populate the above database with information related to Network infrastructures, the agency already issued the ordinance N: 18 of June 3, 2005 for the content, the conditions and the order for creating and maintaining the specialized maps and registers for the telecommunication infrastructure constructed by operators[2]. The ordinance is to determinate the contents, the conditions and the order for creating, maintaining and preservation of specialized maps and registers of the telecommunication infrastructure constructed by operators.

Austria

In Austria the Cadastre of Telecommunication infrastructures is not completely available yet, however its legal necessity is defined in the federal act: Telecommunications Act 2003 (TKG 2003)[3] with the purpose to promote competition in the field of electronic communications so that the population and the economy can be provided with reliable, low-cost, high-quality and innovative communications services. Actually for the realization of the cadastre just the information related to the transmitters are available, in fact due to the situation where Transmitter stations for wireless communication have to be registered, a directory of all transmitters in Austria already exists, available in a dedicated portal at http://www.senderkataster.at.

Greece

A Cadastre of TLC infrastructure has not been implemented yet in Greece, but steps in this direction have been made. At this moment, there is an ongoing tender for a project entitled "Digital Records Development for Greece's Network Infrastructure".
The project is funded by the European Regional Development Fund (ERDF) and aims at the development of a digital, web-based, interactive application, through which it will be possible to record and monitor the status of all available network infrastructures of the country, that support the telecommunications connections of citizens or businesses, as well as their access to broadband online or offline services.

Examples include the following:

- Core networks (backbone) for the collection and transport of telecommunication traffic, such as fiber optics, wireless backhaul links, MAN, optical or satellite links etc.
- Local access infrastructure, such as ADSL networks, WiMAX, public wifi hotspots, new generation mobile networks (3G, 4G), satellite links and Hubs, etc.
- Points of Presence and / or co-location centers in public telecommunications

[2] http://www.cadastre.bg/en/normative-act/ordinance-no18-june-3-2005-content-conditions-and-order-crating-and-maintaining-special.
[3] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20002849

network,

- Internet, or other networks available for public use
- Specialized telecommunications networks of public services relating to the provision of services of general interest
- Stations broadcasting television programs, national or local scale.
- The range of frequencies that is available (either free or by licensing) for the provision of ICT services

For the time being, available TLC mapping exists only for broadband connections[4] developed by the Hellenic Telecommunications & Post Commission, the National Regulatory Authority, which supervises and regulates the telecommunications as well as the postal services market[5]. However, the map focuses on theoretically achieved access speeds and not infrastructure-related information, such as technology utilized (cables, fiber etc.).

Currently, there are no laws that aim to promote the construction of new generation infrastructure and adapting existing ones to meet the appropriate requirements with the development of technology and so there are no provisions that stimulate or require by the operators technical and economic information, they have just to register the type of the services they provide. The only specific information that providers are forced to share is the licenses for antennas for mobile communication. Specifically, mobile providers are obliged to have in public view at their site, detailed information and the exact location of their antenna deployments.

On the other hand, public entities (municipalities, state) sometimes preserve records on street level operations (such as cables, fiber optics etc.), but it is usually done in a very specific scale and the results cannot be exploited efficiently. Private TLC operators probably have analytical schematics of their network's infrastructure, although they usually are reluctant to share that information. As a result, it is difficult to obtain adequate information on TLC infrastructure without determined, coordinated, large-scale research.

FYROM

In December 2012, software presenting the underground infrastructure of the telecommunication network was released in FYROM[6].
The official body responsible for interaction and regulation of the cadaster is the Agency for electronic communications of FYROM (AEC).

The AEC is established with the Law on Electronic Communications ("Official Gazette no.

[4] http://mapsrv1.terra.gr/eettutilities/mapnew.aspx
[5] http://www.eett.gr/opencms/opencms/EETT_EN/index.html
[6] http://tkmrezi.aek.mk/gisPublic/

13/2005, 14/2007, 55/2007, 98/2008 and no. 83/2010) in 2005 as an independent regulatory body in the electronic communications markets. For the purpose of regulating the electronic communications market in a systematic manner, the Agency has tightly defined objectives to be achieved. The Agency has directions to achieve the goals of a competitive market in which the conditions would be created for end users to use electronic communications services with best quality and prices. Of course, to follow such practices, the Agency has a clear strategy for market development that should be achieved as well as a defined path that should be followed in a short and medium term.

According to the action plan of the Government of FYROM, a Law for underground cadaster under the regulations of the Cadaster of real-estate should have been voted in the parliament by 2011. The law has not been voted yet, but AEC had released the above-mentioned software and implemented it since 2012. During the promotion of the Cadaster for telecommunication infrastructure, the AEC has stated that all the operators are obliged to provide information for their infrastructure and the infrastructure that is not going to be added on this map would be considered as illegal. The fine for illegal infrastructure is planned to be 10% of the yearly income of the operator. Unfortunately, there's still no law which the agency can rely on or the operators or ISPs can refer to in such occurrence. There is only a Rule of the Agency of Electronic Communications[7]. The AEC is responsible for maintaining the database, request for data as well as providing the budget for all its costs.

Stakeholders that must provide data for their telecommunication infrastructure (underground, above ground) are the following:

- Private internet service providers (operators)- there are no public entities
- Private telecommunication companies- there are no public entities
- Public or private television houses with own infrastructure
- Public or private radio stations with own infrastructure

The Electronic registry contains data, provided on national level, related to public electronic communication networks for:

- Telecommunication objects
  - Data for the geographical location of the object. Municipality, area or address
  - Geo-coordination system according to which the coordinates have been provided
  - Graphical image of the dimensions of the objects
  - Technical detail of the equipment including type, purpose, materials and capacity
  - Usage of the capacity
  - Period and date of when the available capacity is reserved by the operator and its future development plans

[7] Available only in Macedonian: http://www.aek.mk/index.php?option=com_content&view=article&id=71&Itemid=101&lang=en).

- Cable tranches.
- Radio transmitters.

Operators have an obligation to provide data for their own communication networks to the AEC through one of the following forms using the given nomination in the Rules:

- Electronic files and/ or data in hard copy which contain the details for telecommunication objects, cable tranches or radio transmitters.
- Delivery over a web interface and data in hard copy.

After the review of the data by the AEC, the technical persons in the Agency will add the data.

Slovenia

In Slovenia there is a collective Cadaster of Public Economic Infrastructures and it is a record in which all public economic infrastructures are kept. For each individual object a record of its origin, type, location, identification and ownership data is kept. Public access to data from the Cadaster is provided to all users[8].

The primary purpose of the establishment of the Cadastre is to show the occupancy facilities of public infrastructure for the entire country, which will in future allow more economic land use planning, safer implementation of interventions in the area and more efficient management of infrastructure facilities.

The geometric sub-scheme adopted is done by polygons, lines, points and the spatial reference system is the National coordinate system D48 through the Gauss-Krüger projection. The Cadastre is governed by GURS (Land surveying administration of the Republic of Slovenia). Owners of public infrastructures (municipalities, relevant ministries, owners of electronic communications, etc..) are required to ensure that the aggregated data on facilities of public economic infrastructures are communicated to GURS in accordance with General act on entry, collection and access to data in the register of infrastructural networks and facilities (Ur.l.RS, št. 107/13). When to charge data is largely dependent on the owners. Inspectorate tasks are instead managed to AKOS (Agency for communication networks and services of the republic of Slovenia).

Italy

In Italy, a Cadaster of Network Infrastructure has not been implemented yet, but several studies have been carried out for its realization. Hereafter a very detailed and exhaustive study, titled "National Cadastre of infrastructure" and carried out by ANFoV (Association for the

[8] http://prostor.gov.si/cepp/GURS_izpis.jsp?ID=%7BB22FC360-1417-4CE9-9E7A-44F1BCF62B3%7D

convergence of communication services) will be briefly described.

The official body responsible for the development of telecommunications networks and infrastructures is "The Ministry of Economic Development (MISE) - Department of Communications"[9], while the duty of ensuring fair competition among the Operators and to protect the fundamental
freedom consumption of citizens is given to The Communications Regulatory Authority (Agcom)[10]. The reference regulatory is made up of the Electronic Communications Code (ECC) (Legislative Decree of 1 August 2003, n. 259)[11].
In order to have a single national strategy to reduce the digital divide in Italy, "The National Broadband Plan" has been called and approved by the European Commission. That plan consists of several scheduled actions aimed at implementing broadband networks in the whole county of Italy. These actions are coordinated by the Ministry of Economic Development through agreements with the regions, and implemented by Infratel (an in-house company of MISE).

The first and huge problem encountered in the realization of the cadastre is certainly, the phase of "Collection of the relative data". In fact it is mandatory to identify standards that force the delivery of technical data needed to compile the Inventory for the owners that can be classified into two general categories:

- Private Telecommunication Operators: the Electronic Communications Code states that operators providing electronic communications networks and services have to promptly provide all the information, including economic ones, to the Ministry of Economic Development (MISE) and to The Communications Regulatory Authority (Agcom)[12]. With particular reference to network infrastructure, the Code also stipulates, in case of excavations within towns, operators must communicate it to the Ministry[13].
- Other Entities (government, local authorities, public utilities, etc.): there are most significant obstacles in requesting data from other subjects because the current legislation doesn't foresee tax rules to that effect exercised by either the Ministry or by AGCOM towards public administrations, local authorities, public utilities, private companies.

Failing a specific legislation, therefore, it was necessary to identify a way to facilitate the acquisition of information by other Entities, as well as by telecommunication operators. In fact the participation in the implementation of the Cadastre cannot have voluntary characteristic, but has to be mandatory in order to make it as much functional and accurate as possible.
Currently there is only a map of the on-air infrastructure, but unfortunately this is not available

[9] http://www.sviluppoeconomico.gov.it/index.php
[10] http://www2.agcom.it/eng/eng_intro.htm#
[11] http://www2.agcom.it/l_naz/cod_comunicaz_dl259_03.htm
[12] Refer to ECC Art.10, par 1
[13] Refer to EEC Art 89, par 3

for public consultations. The Communications Regulatory Authority (Agcom) owns this on-air Cadastre and operators are obliged to provide their on-air infrastructure data on regular basis to the AGCOM, but in the direction of the realization of a complete Cadastre of network infrastructures there is the already mentioned study ("National Cadastre of infrastructure"[14]) carried out by ANFoV, which has achieved positive results by relevant institutions like MISE and AGCOM, and is carried out with the participation of the largest telecommunications company joining to the same association (ANFoV) and with the significant contribution of some important Italian Municipalities that have shared premises and aims.

Various aspects necessary for the realization of a Cadastre of network infrastructure have been analysed in detail by ANFoV and have been really useful for the realization of the methodology proposed in the following paragraphs.

The study assumes the real and urgent need for the development of the broadband and ultra wide networks to advance quickly the "computerization" of Italy not only for an alignment with other EU countries, but especially to make the public administration more efficient and enable the private companies to evolve their offerings competitively in the local and international markets. In this context, the use of infrastructure currently available in the subsurface of the national territory can help to speed up this development with a significant reduction of investment: an effective management of existing infrastructure is therefore essential. It is necessary to set up, update and manage a nationwide "inventory" ("Cadastre") of infrastructure, filled by telecom operators and by all public and private entities that own or build infrastructure used for the development of new telecommunications networks.

7.3 Type of Infrastructures

Taking into account an entire country, there are different types of infrastructure based on the purpose they have been built for. In addition to telecom operators, there are other stakeholders, such as private operators, publics utilities (gas, lightning, water, etc.), municipalities, who have the appropriate infrastructures according to the service they are going to provide. Therefore, in the realization of a new network infrastructure, it might be the chance to share the ones already in place in the territory, focusing the construction only on civil infrastructures really missing for the purpose in conjunction with the implementation of other types of public works, for instance, this will help to minimize multiple interventions.

According to that, telecommunications operators will be able to take advantage of the infrastructure available in the territory and select the best technology solution that fits their

[14] http://www.anfov.it/s_leNostreAttivita/studi%20e%20documenti%20ufficiali.html

needs in the realization of telecommunication networks.
Since the Cadastre must take into account all different types of infrastructures, a classification of these resources is necessary based on the assessment of their use. Essentially, if they can or cannot be shared in the construction of telecommunication networks.

In particular, two main types of infrastructures can be distinguished:

- Infrastructures built specifically for telecommunication networks;
- Infrastructures built for purposes not related to telecommunications.

It is evident that in the case where there are infrastructures of any type not in service, they can be fully used according to what it is intended to realize. Due to the high savings of such a solution, it should be considered as a first option within the plan of a new network.

Infrastructures dedicated to Telecommunications Networks

Infrastructures dedicated to telecommunications networks are generally owned by Telecom operators. This means that Telecom operators can share their own infrastructure with other Telecom operators that are going to provide the service or needing a new infrastructure. It is not uncommon, however, that some local authorities (municipalities, regions, etc.) possess this type of infrastructure developed for their own networks (MAN) or for other future purposes (e.g. supporting networks).
In this regard, the sharing of infrastructure can be defined according to the characteristics and technical specifications of the single element part of the network. For instance, regarding the pipes, the sharing can be based on:

- Type (Polifora Tubing, Multi-pipe, Optical Fiber, etc.)
- Maximum capacity of cables
- Maximum occupation of cables

Regarding the Antennas, the sharing allows installing on single structures (building, tower, pale, etc.) used in various technologies, mobile and broadcast (FM and TV).

Infrastructures built for purpose not related to telecommunications

There are various types of infrastructures created for different use than telecommunications:

- electrical networks
- sewerage
- networks for water
- gas networks
- heating networks

- lightning networks
- others.

Quite often a classification enabling an assessment of applicability for these networks is not publicly available, but if they have free or partially occupied infrastructures, it is possible to apply the same sharing criteria valid for telecommunications networks. In addition, if there are no infrastructures to share, it can be considered the chance to create new ones with the support of the existing ones. For instance, it might be possible to create pipes inside pipes (sewerage) already in place or pipes supported by other pipes (lightning network on air) already in place.

In some cases, these infrastructures provide good protection, for instance, to fiber cabling. This is the case with gas and water pipes, thanks to the positioning significantly below the level of the road surface and other infrastructures.
The advantages of this type of sharing consist in exploiting the route of the pipeline already in place and already prepared to reach users all around the area. At this, it must be added a relative speed of installation and reduced invasiveness.

National Cadastre of Network Infrastructures

The following chapters are intended to provide guidelines for the creation of a National Cadastre of Network Infrastructures. It is important to highlight again what is meant by "National Cadastre of Network Infrastructures": a complete database of the network infrastructures of public utilities (telecommunications, gas, water, sewerage, street lighting, etc.) on the national territory, to be used for the management of infrastructures themselves. So, the technical, architectural and procedural aspects of the creation of a National Cadastre are analyzed to define the required specifications in order to plan, design and implement a new infrastructure effectively.

Due to the complexity of the project, there are many problems, related to census data, procedures for requesting data, the management of the Cadastre, the definition of a model of the Cadastre. According to these issues, the document has the following objectives:

- To know the existing infrastructures in the area;
- To use the existing infrastructures in a synergistic way, if it can be reused for this purpose.

Objectives of the Cadastre

The National Cadastre is a unique operational tool managing the whole infrastructures available information in the national country. It will be kept up to date by the owners or managers of the infrastructures. In most of cases, this information is already documented, but in different formats on different databases and not all of them fully computerized. According to that, through the information on the existing and potentially usable infrastructures, the National Cadastre will be the unique tool that allows planning a new network infrastructure implementation in an optimal way, lowering time and costs design.

The information will so be able to let such pre-feasibility studies, budgets and plans in the short/medium term, enabling operators or entities that access to reach the following objectives:

- To know the status of the infrastructures available in the area of interest;
- to identify the owners of the infrastructures in order to investigate technical/design aspects;
- to identify points of access to existing infrastructures in order to assess what are the potential connection points of a new infrastructure with the ones already present in the same area;
- to assess the feasibility of a new project, performing specific analysis in a completely autonomous way on the existing infrastructures that can be potentially used, in order to check if they can be shared according to what it is wanted to accomplish;

While on one side the Cadastre supports its users for the reasons mentioned above, on the other side, through the accurate knowledge of the status of infrastructures in the various areas of the country, it will allow the regulatory authorities to facilitate the allocation of public and/or private funding effectively. In doing that, regulatory authorities shall promote projects of co-development and sharing of new network infrastructures, minimizing effort and waste.

Data of the Cadastre

The creation of a national Cadastre of all infrastructures is an activity that has to take in count the difficulty that the infrastructure owners may have in populating and updating data of the Cadastre Database. The difficulty is due to the large amount of data behind an infrastructure, as the technology, structure, material used, size, technical specifications, etc.

According to that, in order to facilitate its feasibility, the information of the National Cadastre has been set to the minimum required to satisfy its main objectives, which are to support:

- the Customers of the Cadastre in the planning of a new infrastructure
- the Manager of the Cadastre in the analysis of infrastructures in a specific area

A streamlined and redundancy-free information model has been proposed with scalability and flexibility characteristics, enabling the possibility to introduce additional data and/or extensions of functionality.

The required data

Only two infrastructure elements have been identified to represent the entire infrastructure present nationally. They can represent both aerial and underground infrastructure, based on the type of service for which they are designed. Each infrastructure element is defined by a series of informational attributes that allow identifying and cataloging the infrastructures within the National Cadastre. The attributes provide a comprehensive overview of the infrastructures, according to the objectives of the Cadastre described in this document. It is possible, anytime and if it is deemed necessary, to add or remove attributes in accordance with:

- the level of details that it are necessary to achieve
- the level of difficulty in collecting and importing the information into the Cadastre

GIS (Geographical Information System) and Basic Cartographies overview

A Cadastre of Infrastructures will necessarily manage data characterized by a precise geographical location, so it is important to provide an overview of the systems defined as GIS.

Talking about GIS, often it is referred to as a computer system able to produce, manage and analyze spatial data by associating each geographical feature with one or more alphanumeric descriptions. GIS differs from other databases in the way they handle the processing and manipulation of geo- referenced data, which can be stored in a DBMS or individual files. In this way, the GIS allows making changes in real time to a cartography, or in general to a map, simply by editing the attributes of the associated database. Vice versa, by changing the geographic data (such as a border or the length of a linear element) also the corresponding fields in the database will be modified accordingly.

The market for GIS solutions is constantly growing, both in terms of quantity (as far as the spread over the years it has gone from a few hundred to millions of users) and quality (in fact areas of use and the specific knowledge are multiplied). In recent years, in particular, it has witnessed an evolution phase of Open Source solutions. Alongside, the main players in the commercial GIS software market as Autodesk, Bentley, ESRI, Intergraph and GE Energy, so called as Open Source solutions, increasingly represent a valid alternative to commercial products both from the economic point of view that technician.

An important requirement of the system is that it is certified OGC (OpenGIS Consortium, the

international voluntary consensus standards organization), in order to allow maximum interoperability with other systems. It is not the purpose of this document a detailed analysis of the characteristics of open source and commercial systems.

The adoption of a GIS inevitably requires the use of cartographies of reference on which to display the documented data. The cartographic reference base should be unique and ensuring continuity throughout the country (eg. TeleAtlas, GoogleMaps). The information contained in the basic cartographic system could be integrated with the possible use of detailed maps that in some areas may become available. Both the basic unique cartography and the local ones must be geo-referenced with the system chosen for the National Cadastre.

Using the Cadastre and its functionalities

As it has been outlined several times, the project of the National Cadastre involves many subjects that will be able to access the information documented in the system. Therefore, a solution that is easily accessible to users who belong to companies, organizations and different geographical areas is of primary importance. The most appropriate solution would be a web-based application that allows uploading, consultation and analysis of data relating to infrastructure.

Due to the plurality of entities involved in the use of the Cadastre, different roles, activities and interests, it is important to enable a granular definition in the profiles of access to the data, in order to:

- Protect and ensure data on each level basis
- Allow a differentiation of the value of some specific data than others

The security of data must be designed in its global significance, involving not only technological aspects but also the processes involved in the data flow, from acquisition to the use of the data.

It is essential to guarantee to the data contained in the Cadastre the following principles:

- Confidentiality: data must be protected from any type of unauthorized access
- Integrity: data must be protected from unauthorized changes
- Availability: data must be ensured with a reliable access

According to that, the users of the Cadastre can have different access profiles according to their role (supervisor, manager, and customer). This can be done through an authentication mechanism in order to login into the system with appropriate user ID and Password. This would allow the system to identify the user requesting access to the data, to check whether they actually have the rights and what type/representation of information they are allowed to access (only a certain area, or only for a certain type of infrastructure, in editable format or for

consultation). The authentication mechanism should even allow the preservation of accesses to the system and the related operations performed during each access through appropriate logs.

Loading Data

As far as loading the data, appropriate functionalities must be implemented which allow a user-friendly approach to institutions, public or private companies, owners or operators involved in reporting the system information related to their infrastructures.

To this end, a default format of data representation should be defined; ensuring the compatibility with the most common formats for interchange of data and it must be provided on – line and batch loading chances without interrupting the continuity of the service.

Basically, the following functionalities should be guaranteed:

- Massive import of data, in manual and/or automatic mode, and ability to load only the variations occurred from the previous loading
- Flexibility to add attributes to existing objects
- Verification of integrity and correctness of the data;

Consultation of Data

The National Cadastre must ensure the possibility of a full consultation of the information, both in case of limited infrastructure of interest and of the totality of the available data in a given local context. For an effective consultation on this information, the development of advanced features for the selection of objects by points, rectangles, circles and polygons, etc. must be provided.

Basically, the following functionalities should be guaranteed:

- Ability to customize new views on data available
- Visualization of the infrastructure on digital cartography
- Ability to export the data of interest in a printable format and/or editable electronic format

Analysis of Data

In support of operators interested in using the infrastructure in a given area, or regulatory entity interested in monitoring the status of the infrastructure of the area, capabilities that enable data analysis can be developed. In particular, it must be possible to quantitatively analyze the various magnitudes in play (for example, the measurement of distances to the ground in incremental mode, examination of the infrastructures selected attributes, etc.).

The management of the graphics rendering must also allow the display of data by optimizing the information content for the various selected scales.

Basically, the following functionalities should be guaranteed:

- possibility of data aggregation according to:
  - area (zone, province, region, city);
  - type of infrastructure (conduits, sewers, ...);
  - owner;
  - other attributes;
- reporting on the availability of data;
- possibility of various analysis through appropriate statistical indicators;
- possibility to emphasize the owner of the infrastructure in a given area and the user.

7.4 Conclusions and Suggestions

On the basis of the technical, architectural and procedural aspects analyzed in this document, the main characteristics on which to base the implementation of the Cadastre are the follows:

- it should contain information on the existing and potentially usable infrastructures for the development of a new network;
- it must be populated by all telecom operators and all parties (public or private) that are owners and / or grant the right of use of appropriate infrastructures;
- it shall allow the Regulator Authority a monitoring on the state of the existing infrastructures in the country;
- it must be managed by an entity that is centralized at a national level and will be:
  - independent and impartial, so a third party with respect to the operators, the Agencies and the Public Utilities feeding the database;
  - engaged with appropriate competences to obtain the supply and update of the data for populating the database by the different parties involved in the process;
  - referenced in the territory to ensure the timely collection of information;

(an important role can be played by municipalities, both for the direct relationship they have with institutional and citizens and for their role in relation to local economic operators from the perspective of territorial development);

- The updating of the data must be guaranteed by all parties involved in the National Cadastre according to methods and timeframe well defined and it is important that the inventory is kept in line with the actual situation of infrastructure;
- The information to be included in the National Cadastre is the minimum necessary to support operators in the phase of planning and the regulatory authority in the analysis phase of infrastructured areas.

- The solution should be easily accessible to users who belong to companies, organizations and different geographical areas. It is suggested a web-based application that allows uploading, consultation and analysis of data on infrastructures with a user-friendly approach.
- For the initial population of the Cadastre of Infrastructures, the Manager of the Cadastre must be supported by appropriate Laws and Regulations that invest it with the adequate responsibility for this purpose. As the updating of data, even the initial population must be guaranteed by all parties involved in the National Cadastre according to methods timeframe well defined by ensuring that the inventory is kept in line with the actual situation of infrastructure.

In conclusion, The Cadastre of Network Infrastructures will properly work providing users with its added values and advantages only if, at least, the following three basic conditions will be satisfied:

- it must be mandatory to populate the Cadastre and keep it updated by stakeholders in a dedicated format (geo-referenced data in digital format; not geo-referenced data in digital format; data in paper and printable format);
- The Manager must be invested by appropriate authority in order to:
  - monitor the status of the Cadastre (if it is correctly populated and updated on regular basis);
  - take proper legal actions towards stakeholders if the previous point is not satisfied;
- it must be mandatory to consult the Cadastre for a new Network implementation and, if the case, to re-use available infrastructures;

So, in conclusion, the suggestion is to follow the guidelines in order to act in terms of what there already is and what is missing from a legal, technical, architectural and procedural point of view in order to have them satisfied.

7.5 Abbreviations

MAN	Metropolitan Area Network
ADSL	Asymmetric Digital Subscriber Line
WiMAX	Worldwide Interoperability for Microwave Access
3G, 4G	Third and fourth generation of mobile telecommunications technology
ICT	Information and communications technology
GIS	Geographic information system
DBMS	Database management system

8) THE GOOD PRACTICE GUIDE

Produced by TECLA
Co-authors: Maša Isaković, Marko Papić

The Good Practice Guide is intended to outline virtual accessibility scenarios and to put under the spotlight successful cases in the SEE area, in order to promote transferability within and beyond the project's consortium.

Virtual accessibility stands for the access to or the use of information and communication technologies (ICT)[1], in order to improve the digital divide of technologies, that is an economic inequality between groups, a social issue referring to the differing amount of information between those who have access to the Internet (especially broadband access) and those who do not have any access.

Data and resources have been collected through primary research and desk research. The primary research was based on a survey addressed to selected field experts and key actors with the aim of producing sufficient evidence to identify good practices.

Instead, in order to cover evidence gaps in the identification of good practices from the primary research, the accessory desk research has been carried out to identify examples and relevant practices aimed at promoting and enhancing broadband access. The desk research was based on information coming from European and International institutions and portals, as well as independent research bodies, from journals and other academic and educational sources, from government and other national, regional and local administrations' websites, from other business and industry sources and finally also from multinational ICT and consulting companies' sites and researches.

Since the collection, identification and evaluation of practices on virtual accessibility involved two main aspects: one regarding broadband infrastructure, and one regard services that valorize and require broadband infrastructure in order to be provided. Consequentially also the guide of good practices will be structured in two parts.

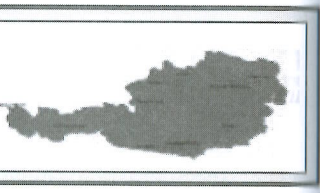
The collection and identification of broadband practices involved not only the SIVA project partners' countries and their territories, but also some other countries of the SEE area.

[1] Virtual accessibility generally refers to access to networks and ICT services, especially for underserved territories as a means to lessen the "digital divide"

8.1 BROADBAND INFRASTRUCTURE CASE STUDY IN AUSTRIA

ARGE Glasfaser Waldviertel

Austrian villages build their own FTTH network



BEFORE THE PROJECT

The local area of the former Iron Curtain, near the Czech border of Austria, involving the villages of Großschönau, St Martin and Bad Großpertholz, had gone into sharp decline since 1945.

In 2003, internet access in these towns was only possible via dial-up or ISDN connections and the ICT operator, Austria Telecom, was not planning to serve small communities with ADSL, and the alternative operators were not interested either.

Moreover, the lack of modernised communications infrastructure was causing a growing exodus of young families and businesses from the region.

REALISATION OF THE PROJECT

The **ARGE Glasfaser Waldviertel** project translates roughly as "Forest Quarter Fibre Co-operative". **Each municipality owns its own duct and fibre.**

Since national internet service providers were not interested in doing business because of the small number of potential subscribers, **the three municipalities joined forces with a regional ISP called WVNET to form an independent company** that now operates the active equipment on the network and offers broadband and VOIP services as well as IPTV services.

The network is set up as an Ethernet LAN, which allows consumers and local businesses to connect to each other at 100 Mbps for free

The Project in Brief

Where:

Großschönau – St Martin – Bad Großpertholz (Austria)

When:

Started in 2005 – Finished in 2011

The Project:

Three small villages in the northeast of Austria have installed a community-owned fibre network that is breathing new life back into the region

Aims:

The small towns were experiencing a problem of high unemployment and a declining population. To slow the exodus of young families and businesses from the regions, the three mayors decided to modernise the communications infrastructure.

Main results:

- **The fibre network passes through 650 homes and small businesses**
- **Students are returning home to study, thanks to the availability of fast**
- **broadband connections**
- **Local businesses are able to collaborate effectively and share computer servers to keep costs down**

COSTS OF THE PROJECT

The project was able to take advantage of planned work on the sewage system to install ducts for a fibre network in the same trench as the new sewer pipes.

Since civil engineering work is usually the most expensive part of this type of infrastructure project, this made it possible to reduce costs substantially, so that the total cost of the network is **under 1 million of €**.

AFTER THE PROJECT

The fibre network passes through 650 homes and small businesses, of which around 250 are receiving services over the network. The aim is to reach all 1500 homes and 150 small businesses in the three communities. Moreover, that may not be the end since other nearby villages are interested in connecting to the network.

8.2 BROADBAND INFRASTRUCTURE CASE STUDY IN BULGARIA

BROADBAND ACCESS PROJECT

LEADING GOOD PRACTICE

The broadband access project is based on the good practice of building an infrastructure for next-generation access (NGA) in the regions of Catalonia, Spain.

THE STRENGTH OF THE PROJECT

The innovation element of the Bulgarian broadband access project lies in the approach to **promoting the demand for the NGA services**, which in most regions are in a latent state and should be promoted in order to become visible and sought by the citizens and the business.

In this sense, the project will rely on **the development of the e-services** which will have a triple effect on the promotion of the demand for NGA services. Moreover, the optical infrastructure will be built in the municipalities which are white areas in terms of Internet next-generation access.

THE DESCRIPTION OF THE PROJECT

The project of building optical networks for fast Internet access is intended **to establish a secure and reliable infrastructure for next-generation broadband access for the needs of electronic governance and for the creation of prerequisites for development of broadband services for the citizens and the business** in economically under-developed and remote regions of the country.

AREAS INVOLVED The deployment of optical infrastructure for next- generation Internet access covers around 860 km, involving **29 municipal centres and 24 small settlements**.

The Project in Brief

Where:

29 municipal centres and 24 small settlements, with an infrastructure coverage of around 860 km (Bulgaria)

When:

Tender ongoing (2014)

The Project:

The deployment of broadband infrastructure (e.g. Next Generation Access Networks, backhaul networks etc.)

Aims:

The deployment of optical infrastructure for next-generation Internet access for the population living outside the regional towns and the capital.

Main results:

4% of Bulgaria's population, 277 765 people of the area, involved in the project, benefiting of internet access.

Budget:

The total value of the project amounts to 20 000 000 €.

The selected settlements under the project have a total territory of 7 919 km^2 or 7% of the territory of the country. They have a population of 277 765 people, that is 8% of the population, living outside the regional towns and the capital, or **4% of Bulgaria's total population**.

EXPECTED RESULTS

The new optical infrastructure will improve the competitiveness of local economy, facilitating and stimulating the IT business of providing new services to the end users, which will result in raising employment and the standard of living of the population.

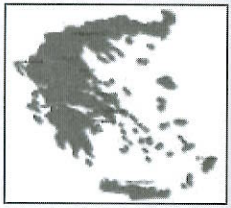
The implementation of the project will ensure favourable and non-discriminatory conditions to Internet providers for the provision of services to the citizens and business based on the modern optical network. Last, but not least, the people, living in sparsely populated and remote regions, will have access to on-line services, which will stop the trend of isolating that part of the population from the public and cultural life of the country. Indeed, 4% of Bulgaria's population, 277 765 people of the area, is involved in the project, benefiting of internet access.

BUDGET OF THE PROJECT

The total value of the project amounts to **20 000 000 €**.

8.3 BROADBAND INFRASTRUCTURE CASE STUDY IN GREECE

DEVELOPMENT OF BROADBAND INFRASTRUCTURE IN RURAL "WHITE" AREAS OF GREEK TERRITORY AND SERVICES UTILISING THE INFRASTRUCTURE



TARGETED AREAS

The project "**Rural Broadband**" involves the installation and operation of broadband network infrastructure to nearly 5 100 "white" rural and island areas, which account for about 40% of the Greek territory

THE PROJECT

The project will provide **fast internet in rural areas of the country by 2015**, connecting hundreds of thousands of people who currently do not enjoy broadband connections.

BENEFITS OF THE PROJECT

In perfect consistency with EU policies, the Rural Broadband project aims to **reduce the "broadband divide" among the most disadvantaged areas of Greece**, where the basic broadband access is missing.

On one hand, this project is expected to **help setting a very considerable areas and local economies as well as boosting employment** during the development, installation and maintenance of networks. On the other hand, it provides the necessary infrastructure to strengthen local entrepreneurship.

With the completion of this project, for the inhabitants of these areas it will be possible to access basic government services such as e-prescribing, electronic connection with the services of the Ministry of Finance, the granting of certificates and documents with electronic applications for citizens.

The Project in Brief

Where:

5 100 "white" rural and island areas, which account for about 40% of the Greek territory (Greece)

When:

Started in 2013 – ongoing

The Project:

Development of Broadband Infrastructure in Rural "White" areas of Greek territory and Services utilising the Infrastructure

Aims:

The project is expected to help setting a very considerable areas and local economies as well as boosting employment during the development, installation and maintenance of networks.

Main results:

The development of the necessary network infrastructure in targeted areas with the provision of reliable and modern broadband services to the population of these areas, adopting a model that will allow sustainable use and operation of infrastructure in the long term, while encouraging competition.

Budget:

In addition, it should enable the **activation of entrepreneurship in regions so far been excluded due to insufficient telecommunications infrastructure.**

THE REALISATION OF THE PROJECT

"Rural Broadband" project is implemented following the **Public- Private Partnerships (PPP)** approach for the development of the planned network infrastructure in target areas and provides reliable and modern broadband services to the population of these areas, adopting a model that allows sustainable use and operation of infrastructure in the long term, while encouraging competition .

The investment model for the implementation of this project is based on **PPP basis DBFO** (Design, Build, Finance and Operate).

BUDGET

The budget provided for the project is **161 077 032 €**.

This intervention is financed by the European Regional Development Fund (ERDF) for National Resources, harnessing resources from the OP "Digital Convergence", "Rural Development in Greece 2007-2013" and "ROP Macedonia-Thrace" under the NSRF and private expenditure derived from prospective contractors of the project.

8.4 BROADBAND INFRASTRUCTURE CASE STUDY IN ITALY

NEXT GENERATION BROADBAND IN VALLE D'AOSTA

BEFORE THE PROJECT

In Italy advanced broadband services and the infrastructure required to support them are available for citizens and businesses in more densely populated areas, whereas **broadband is inadequate or outright lacking in the areas which are not commercially attractive for electronic communication operators.** This leaves citizens and business without the possibility of adequate broadband access and services. That is the case of the Region of Valle d'Aosta.

The deployment of infrastructure that allows an adequate offer of broadband services is hindered by historical, economic and social factors in addition to the geographic characteristics of the territory.
In particular:

- **The Region is characterised by small towns where the population is diminishing;**
- **The economy is based on small enterprises that are mainly engaged in tourism and farming activities;**
- **There are significant economic differences between the towns located in the central valley and those located in lateral areas.**

The aspects mentioned above hinder the viability of private investments in most disadvantaged areas. The scarce level of potential users makes the investments in upgrading the network in order to provide ultra-speed broadband services commercially uninteresting from a private investor perspective.

The Project in Brief

Where:

Valle d'Aosta Region (Italy)

When:

Started in 2012 – ongoing

The Project:

The deployment of a fibre infrastructure in order to connect existing central offices (telephone switch) as well as the main radio towers for mobile connection

Aims:

Ensure a very high speed broadband network (NGN) coverage across the whole territory of the Region, so that operators could offer very high speed broadband services to citizens, public institutions and businesses

Beneficiaries:

- **An electronic communications operator offering very high speed broadband services selected through a competitive tender process**
- **The telecommunications services operators who will be able to provide internet service to the end-users thanks to the public financing of the infrastructure**

Thus the project is aimed at the whole territory of the Region which is characterised by sparsely populated areas and very low population density.
This is due to the geographical characteristics of the Region, which is divided into a central valley where most of the population, businesses and economic activities are located, and other peripheral areas.

DESCRIPTION OF THE PROJECT

The project supports the **development of a very high-speed broadband network in the Region of Valle d'Aosta,** characterised by difficult topography. The project provides for creation of a transport network able to cover the whole region's territory, **an optical fibre network in the lateral valleys connected to the backbone in the central valley** (Step 1).
In addition, it is provided a **fibre connection extending both to the proximity of the base radio stations of the mobile operators** (Step 2), in order to enable 4G standards with wireless access, and to the proximity of existing fixed telephone cabinets, where this could have been done considering the area in which the backbone is laid.

BENEFICIARIES

The direct beneficiary of the project is an **electronic communications operator** offering very high speed broadband services selected through a competitive tender process.
Moreover, for the second step, the direct beneficiaries are the **telecommunications services operators** who will be able to provide internet services to the end-users thanks to the public financing of the infrastructure.
Indirect beneficiaries of both steps are **electronic communications operators utilising the new network through the wholesale access products** for offering retail services to consumers.

AIMS

The project is intended to **address digital divide in the Region in a long-term view.** The intervention is aimed at deploying a fibre infrastructure in order to connect existing central offices (telephone switch) as well as the main radio towers for mobile connection.
The final goal is to **ensure a very high speed broadband network (NGN) coverage across the whole territory of the Region**, allowing operators to offer very high speed broadband services to citizens, public institutions and businesses.

BUDGET AND AID INTENSITY

The total public aid amounts to **26 100 000 €** financed directly by the Region who provides the access to the European funds **through the European Regional Development Fund (ERDF).** The infrastructure deployment is fully covered by State intervention, whereas, as regards the investments for the completion of the network, the state aid intensity does not exceed 40% of the

costs borne by the operator for network activation.

8.5 BROADBAND INFRASTRUCTURE CASE STUDY IN FYROM

WI-FI COVERAGE OF FYROM

BEFORE THE PROJECT

In rural areas of FYROM, the private sector has seen no opportunity for swift return of investments in communication networks.

The "Wi-Fi coverage" project therefore grants subventions to that effect, namely the operators are to install the equipment, while the Government will pay for their service in the next four years.
Afterwards the operators will become owners of the Internet Infrastructure.

THE PROJECT

FYROM Government launched a four-year project for setting wireless Internet infrastructure at 680 locations in rural areas across FYROM.
The main priority of the project "Wi-Fi coverage of FYROM" is to encourage and support the development of the ICT sector in the Republic of Macedonia.

AIMS

The aim of the project is **to prepare the FYROM citizens for the modern IT economic market**, by helping them to be prepared for the competitive global economics.

EXPECTED RESULTS

In the future, the project will focus on **increasing the number of Internet users in FYROM**, enabling the internet to become approachable tool for everyone.
The internet training of the citizens will improve the

The Project in Brief

Where:

680 locations in rural areas across FYROM

When:

Started in 2009 – Completed in 2012

The Project:

The building of wireless Internet network in rural areas

Aims:

- **To iron the digital gap between the rural and urban areas**
- **To stimulate operators to invest in building of such networks.**

Main results:

The building of free of charge Internet kiosks on the whole territory of FYROM, as well as hot spots with free of charge Wi-Fi Internet

Budget:

Moreover, the project aims at lessening the digital gap between the rural and urban areas, as well as stimulating operators to invest in building of such networks.

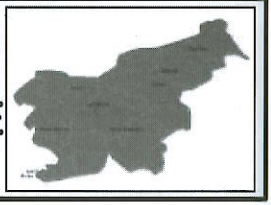
business and the economic environment in FYROM.

Within the framework of this project, it is envisaged to build free of charge internet on the whole territory of FYROM, as well as hot spots with free of charge Wi-Fi Internet.

Thus, in conclusion, in the next four years the operator is to offer free internet after installing own equipment, while the Ministry of Information Society will only pay for the broadband service.

8.6 BROADBAND INFRASTRUCTURE CASE STUDY IN SLOVENIA

BUILDING AN ELECTRONIC COMMUNICATIONS INFRASTRUCTURE



BEFORE THE PROJECT

Ensuring broadband high-speed access in rural and remote regions will either suffer considerable delays or in some parts will not happen at all. The main reason is a poor return on investment (ROI) in low populated areas. However, broadband access can be offered also by wireless technologies.

Therefore, a deployment of a certain combination of digital subscriber line technologies (xDSL), fiber to the home technologies (FTTx) and wireless technologies may be an optimal solution, considering decreasing range of xDSL technologies, vast investments needed for point-to-point fiber to the home solution (PtP FTTH) and growing deployment of broadband wireless technologies.

DESCRIPTION OF THE PROJECT

The "BANeT" optimisation tool is an application developed by the Laboratory for telecommunications, University of Ljubljana. It optimises placement of remote DSL multiplexers (rDSLAM) following different bandwidth demand and investment threshold scenarios. Its tree structure network model considers several real network parameters (e.g.: copper cable lengths, user coordinates, node coordinates). Fixed broadband coverage can be supplemented by installing WiMAX antennas at or near operators' central offices, thus relatively high throughput is provided to users far from DSLAMs.

Intended technology:

The Project in Brief

Where:

the municipalities Slovenska Bistrica, Poljčane, Makole and Majšperk (rural areas of Slovenia)

When:

Started in 2007 – Completed in 2013

The Project:

The building of an Electronic Communications Infrastructure within the framework of National Broadband Networks

Aims:

to assure access to broadband network connections to users on the entire area of the municipalities Slovenska Bistrica, Poljčane, Makole and Majšperk, with satisfactorily speed

Results:

- **Application upgrade possibilities**
- **Technology combination analysis**
- **Techno-economic analysis**
- **Modular construction**
- **simplicity**

Budget:

Project is co-financed through European Regional Development Fund.

Provider has estimated a construction of hybrid network. The main part of the network will be implemented with **optical fibres (backbone)**, some parts of the network, especially in remote areas, will be implemented through **air (Wi-fi)**.
New infrastructure can be connected to the existing network through multiple transmission capacity to provide access to larger number of users. Local distributing network will be implemented in MHBDS digital transmission DVB-T technology. Project intends setting up six telecommunication towers. In areas, where MHBDS tehnology will not cover up all users, provider has estimated the use of WiFi technology with transmitters, connected to the main transmitter in Boč.

OBJECTIVES OF THE PROJECT

The main objective is to assure **access to broadband network connections to users on the entire area of the municipalities Slovenska Bistrica, Poljčane, Makole and Majšperk, with satisfactorily speed, with long-term objective to connect the majority of population in this area in a highly effective network**. The goal of preference policy after the conclusion of programming period 2007-2013 is to raise the number of population with broadband access from 92 to 100 percent. Techno-economical analysis of strategic presumptions with next version of BANeT verification.
Optimal placement of remote DSL multiplexers (rDSLAM) following different bandwidth demand and investment threshold scenarios. Tree structure network model considers several real network parameters (e.g.: copper cable lengths, user coordinates, node coordinates). Fixed broadband coverage can be supplemented by installing WiMAX antennas at or near operators' central offices, thus relatively high throughput is provided to users far from DSLAMs.

RESULTS OF THE PROJECT

Successfully implemented investment results in development and structural adjustment of regions which are lagging behind, especially in rural areas. It provides equal recourse to broadband services for all users, which can lead to decreasing depopulation, especially young people from rural areas to bigger cities. The efficiency of educational, research, cultural and healthcare foundations also increase.

Strengths of good practice:

- application upgrade possibilities
- technology combination analysis
- techno-economic analysis

- modular construction
- simplicity

BUDGET

Project is co-financed through European Regional Development Fund.

It is organised as Public-Private Partnership in which a part of costs shall be borne by private construction works contractor.

8.7 BROADBAND INFRASTRUCTURE CASE STUDY IN THE SEE RURAL AREAS USING THE PPP MODEL

TACKLING THE BROADBAND GAP IN SEE RURAL AREAS THROUGH PPP MODEL

SOUTH EAST EUROPE
Transnational Cooperation Programme

BEFORE THE PROJECT

Across the South-East European territory there are **rural areas with high percentage of people living with no or very weak broadband internet coverage** being a part of the broadband gap. It is proven and well known that broadband gap has negative impact on economic growth and social cohesion.

DESCRIPTION OF THE PROJECT

PPP4Broadband aims to improve the development of virtual accessibility in South-East European rural areas, using PPP model, in order to increase rural economic and social development. Concept of PPP means cooperation of public and private actors since the solution lies with their bilateral action.

PPP4 Broadband will develop and promote common PPP models and guidelines for the governance sector.

Broadband should be provided by the private providers mainly. Rural areas, specified by the low density of population, are not attractive for private providers, we are calling these areas as areas of market failure.

In these areas the public partner role in the infrastructure development and deployment is needed. Public sector, especially currently, in time of austerity measures, has not often had the capacity to solve Broadband gap in rural areas alone, thus there is need for the cooperation between Private and Public actors

The Project in Brief

Where:

9 countries involved: Slovenia, Slovakia, Serbia, FYROM, Austria, Greece, Romania, Bulgaria, Hungary

When:

Started in 2013 - ongoing

The Project:

The development of virtual accessibility in South-East European rural areas, using Public-Private Partnership model, in order to increase rural economic and social development

Aims:

To provide the public actors with advisory, guidance and expertise on the broadband internet development, tackling the "digital divide " and improving the virtual accessibility of information, public services and territories

Main results:

PPP4Broadband methodology will be demonstrated in three pilot areas, in Greece, FYROM and Romania, where investments based on three selected PPP4Broadband models will be elaborated.

AIMS OF THE PROJECT

The methodology will help to provide the public actors with advisory, guidance and expertise on the broadband internet development and consequently **tackle the "digital divide" and improve the virtual accessibility of information, public services and territories.**

It will foster the use of advanced ICT and reduce the need of inhabitants to travel and will replace physical mobility through virtual exchanges.

RESULTS OF THE PROJECT

To prove and to demonstrate the project concept, PPP4Broadband methodology will be demonstrated in three pilot areas, in Greece, FYROM and Romania, where investments based on three selected PPP4Broadband models will be elaborated.

8.8 CONCLUSIONS

South-East Europe features many "white" areas for which no specific planning proposal for broadband infrastructure has been adopted, often corresponding to rural areas without advanced broadband infrastructure that are not commercially attractive for ICT operators.

The importance of a quality broadband infrastructure in Europe is essential to ensure quality services to citizens and local public administrations, giving them an adequate offer of broadband services.

Despite broadband infrastructure still shows gaps in the coverage, capacity and quality, the European Union marked the importance of a better and faster broadband as a top priority in the Digital Agenda for Europe, the flagship initiative of the European 2020 Strategy, aiming at fostering economic growth.

The Digital Agenda not only set ambitious objectives for broadband infrastructure development, namely to bring basic broadband to all European by 2013, but also ensures that by 2020 all Europeans could have access to much higher internet speeds of above 30 Mbps as well as 50% or more of European households could subscribe to internet connections above 100 Mbps.

To achieve the objectives of the EU Digital Agenda, the European Commission provided a guideline for the application of **EU state aid** rules to the broadband sector for Member States, containing in particular a reinforcement of open access obligations and improved transparency rules.

The help of European Union by means of EU state aid facilitates well-designed aid targeted at market failures in order to achieve growth-enhancing priorities, while simplifying the rules to allow for faster decisions. Public administrations involved in the survey, indeed, stressed that the deployment costs and the funding of infrastructure broadband projects are considered important implementation issues.

Moreover, from a deep analysis of the survey, the most relevant difficulty encountered among all the countries during the implementation of infrastructure broadband projects was mostly the lack of expertise in managing ICT projects.

In this general framework, the role of **public-private partnerships** is essential to bridge the mismatch in expertise, reducing costs of investments for the public, especially in the economic crisis context all Europe is facing, by attracting investors, entrepreneurs and improving the quality of life of European citizens.

The public-private partnership ensures to provide broadband infrastructure investments for the public, through a partnership of government and one or more private sector companies, based on a contract in which the private party provides a public service or project assuming substantial financial, technical and operational risks in the project.

In this context, there are a number of areas where existing laws of a host country may need to be modified to allow for successful infrastructure PPP projects, such as enabling the grant of step-in rights to lenders and requiring open and fair procurement processes. These modifications may be embodied in sector-specific law, or in the case of procurement, a procurement or competition law, or they can be included in a general concession or PPP law.

For this reason, the need of national PPP legislations, as uniform as possible across European countries, explicitly mentioned in the survey as one of the barriers encountered during the implementation of broadband projects, is definitely the primary condition for the development of successful public-private partnership projects, and more in general for the development of broadband infrastructures.

SERVICES

Broadband services, also known as "universal broadband services", refer to government efforts to ensure all citizens have access to Internet, narrowing the digital divide (or digital split), that is the differing amount of information between those who have access to the Internet (especially broadband access) and those who do not have access.

What matters the most is not only providing the access to the Internet by deploying basic broadband connectivity, but also providing it at affordable prices with an adequate quality of connection and the related service availability.

The good practices collected in the survey and via desk research involve all the types of services that valorise and require broadband infrastructure and broadband connectivity, facilitating and enhancing the electronic communication and exchange of information among the interested parties.

The identified services indicatively include:

- E-government services
- Satellite broadband Internet access services

- Digital entertainment services
- Cloud computing services that could involve data storage and file transferring

The practices include the implementation of public initiatives and private investments that in some way imply the articulation of public interventions regarding the promotion of broadband access in the SEE programme area.

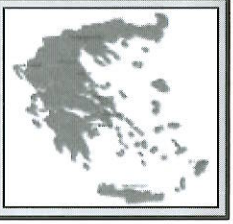
The collected practices that concern services based on broadband infrastructure indicatively provided information about:

- Type of provided services
- The speed requirements of the provision of the service
- The main achievements of the practice
- The maturity level of the practice
- The difficulties and problems encountered
- The operational impact of the practice
- The possibilities and the degree of transferability of the practice

8.9 BROADBAND SERVICE CASE STUDY IN GREECE

GREEK SCHOOL NETWORK

The network in the service of Education



THE PROJECT

The Greek Schools' Network is the educational intranet of the Ministry of Education and Religious Affairs, which interlinks all schools and provides basic and advanced telematics' services. Thus, it contributes to the creation of a new generation of educational communities, which takes advantage of the new Informatics' and Communication Technologies in the educational procedure.

The implementation of the Greek Schools' Network is funded by the Framework Programme for the Information Society, in close cooperation between the Ministry of Education as well as 12 Research Centres and Highest Education Institutes, specialized in network and Internet technologies.

EDUCATIONAL EXPLOITATION OF THE GREEK SCHOOLS NETWORK

The current design and implementation of the Greek Schools Network focuses in providing useful services to all members of the basic and middle education community, fulfilling among others the following goals:

The Project in Brief

Where:

Schools in Greece

When:

Since 1999

The Project:

The educational intranet of the Ministry of Education and Religious Affairs, which interlinks all schools and provides basic and advanced telematics' services

Aims:

The provisioning of useful services to all members of the basic and middle education community

Main results:

Currently, all educational and administrative units of the second educational degree are part of the Greek Schools Network, as well as 96% of the first-degree educational units.

- Access to telecommunicationand services
- Access to digitized educational material
- Distance learning, e-learning
- Encourage collaboration
- Information and opinion exchange
- Conduct of thematic discussions, seminars, lectures, etc.
- Access to digital library services
- Communication and Cooperation of all educational degrees
- Communication with European educational networks
- Facilitate complimentary educational programs
- Provide education to individuals with special needs or disabilities
- Inform, educate, entertain

NETWORK ARCHITECTURE

The network is hierarchically structured into three layers:

- **Core Network**: The Greek Schools Network interconnects with the Greek Research and Technology Network (GRNET, www.grnet.gr), in seven main points (Athens, Thessaloniki, Patras, Heraclion, Larisa, Ioannina and Xanthi), using it as its core network.
- **Distribution Network**: The Greek Schools Network installs in the capital of every prefecture network and computational equipment, thus ensuring optimal access of the prefecture's school to the network and its services.
- **Access network**: It is used to directly and efficiently interconnect the schools to the prefecture's access point. The telecommunication junctions used to interconnect each school are selected based on financial and technical criteria from an array of available options:
    - Digital ISDN circuit (bandwidth: 64 - 128 kbps)
    - Analog leased line (0,128 - 2 Mbps)
    - Public Switched Telephone Network circuit (56 kbps)
    - Wireless link (10 Mbps)
    - VDSL circuit (10 - 15 Mbps)
    - ADSL circuit (384/128 Kbps, pilot implementation)

TARGETED USERS

In order to maintain the educational orientation of the network, its users are certified individuals, educational or administrative entities of the National Education. In particular, the users are divided in the following categories:

- **Schools**:
- At least one user account have been provided to all middle grade education schools and 92% of first degree education schools.
- **Administrative units**:
- At least one user account has been provided to more than 2.282 administrative units of National Education.
- **Educational staff**:
- The Greek Schools Network offers fully personalized access to all educational staff, with the dial-up service being broadly used under certain terms.
- **Students**:

Network access is provided to students through the school laboratories. In addition, personalized access is offered to second grade students since September 2008.

- **Administrative staff**:

As with educational staff

8.10 BROADBAND SERVICE CASE STUDY IN ITALY

BRESCIAGOV

A SERVICE PORTAL OF PROVINCIA DI BRESCIA

DESCRIPTION OF THE PROJECT

BresciaGov is the portal of the services of the Province of Brescia addressed to citizens, companies and organisations in the area.

The services are divided by type of user and are navigable according to different logics:

- alphabetical order,
- life event,
- topic of interest,
- type of service

For each service corresponds an information document (guide service) that describes it briefly, indicating which regulations refers to, what are the requirements to access it and what practices to be forwarded to the institution.

The services on BresciaGov are of different types: in some cases there are information and downloadable forms for the start of practice, in others it is possible to carry out the whole process (compilation, sending the form, any payments) entirely on- line. This type of service is identified by the words "on- line".

The services currently available are issued by 62 local authorities in the Province of Brescia for a total of 1970 services, broken down according to the target to which they are addressed:

- Citizen (1212 services)
- Enterprise (572 services)
- Organizations (186 services)

The Project in Brief

Where:

Provincia di Brescia (Italy)

When:

Since 2012

The Project:

BresciaGov is the portal of the services of the Province of Brescia addressed to citizens, companies and organizations in the area

Aims:

The deployment of e-services of Public Administration for citizens, companies and organisations in the Province

Main results:

The Province of Brescia has launched the Free Wi-Fi BresciaGov which includes the activation of Wi-Fi access point for free Internet access in the province

FREE WI-FI BRESCIAGOV

The Province of Brescia has launched the Free wi-fi BresciaGov which includes the activation of Wi- Fi access point for free Internet access in the province.

The system consists of a centralised management platform and a network of hot spots, distributed in all the area of Brescia, the most frequented by locals and tourists. The centralised platform manages the operation of antennas located on the territory and allows the registration and authentication system for free navigation on the Internet.

The project plan aims to activate 1000 Wi-Fi point areas located within the province: in the pilot phase 25 antennas are installed in buildings of territorial offices of the Province, later 75 hotspots are subsequently released and then the other 900.

The network Free Wi-Fi BresciaGov joins the Federation of Public Administrations "Free Italy Wi-Fi" (http://freeitaliawifi.it) counting 26 federated networks, of which 15 are already interconnected with each other, with the aim to participate in the building of a single network where users can navigate using the same credentials obtained from the reference manager of its territory.

Users from Brescia, with the use of their username and password, can surf even in the territories of federated entities in "Italy Free Wi-Fi", including the provinces of Rome, Florence, Grosseto, Pistoia, Prato and Gorizia, the Region of Sardinia, the Gran Paradiso mountain community and the cities of Venice, Turin and Cesena.

The primary intent is to enhance the spread of free public WiFi, favouring the emergence of new networks and promoting digital literacy and the right of access to the internet in the Italian Public Administrations.

8.11 BROADBAND SERVICE CASE STUDY IN FYROM

USLUGI.GOV.MK

DESCRIPTION OF THE PROJECT

USLUGI.GOV.MK a result of the efforts of the Government to work more efficiently with a transparent administration by enabling the public presentation of services oriented towards citizens and businesses.

The need to establish a portal uslugi.gov.mk was additionally imposed by the adoption of the first phase of the Law on Free Access to Public Information. The obligation of transparency in the work of the public administration is established in the Law on organization of work of the state administration, where his responsibilities were based on the principles of legality, accountability, efficiency, effectiveness, transparency, equity and predictability.

By establishing uslugi.gov.mk as single point of access to information about the services, the Government offers citizens and businesses to enable

- To reduce time required to find information on government services
- Timely and easy access to information about changes in the government services
- Less time for distributing information services
- To Connect the bodies of the government and establish a starting point for establishing a central point for building the "government knowledge"

The Project in Brief

Where:

FYROM

When:

Since 2005

The Project:

The web portal uslugi.gov.mk presents all the services that are provided by the public institutions, with data for the responsible organs for each service, their contact details as well as forms for specific services provided by them.

Aims:

The portal has the aim to ease the access to services of the citizens, by having only few clicks on one page to receive the information needed.

- To establish procedures for simple change of existing and new services

USLUGI.GOV.MK is a system with scalable architecture that allows users to simply expand the capacity at the moment when the need arises.

The web portal **uslugi.gov.mk** presents all the services that are provided by the public institutions, with data for the responsible organs for each service, their contact details as well as forms for specific services provided by them.

The services in brief:

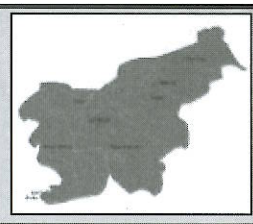
- MI - Free Phone Number 0800 192 92 to schedule appointment for passport
- Notification by SMS raising personal documents prepared
- Payment of stamp duty through SMS
- New ID cards and driving licenses
- Appointment to apply for identity documents
- Meet the new Law on Safety in Road Transport
- Government and Microsoft announced the introduction of new e-government services for citizens
- Macedonian solutions presented at Microsoft Services Networking Summit 2006 in Barcelona
- Free training in computer use
- Public inspection of the voters List

AIMS

The portal has the aim at **easing the access to services of the citizens, by having only few clicks on one page to receive the information needed.**

8.12 BROADBAND SERVICE CASE STUDY IN SLOVENIA

E-GOVERNMENT & E-HEALTH IN SLOVENIA



E-GOVERNMENT LEGISLATIVE FOUNDATIONS

Slovenian e-government efforts started in 2001, when the government adopted its first formal nationwide strategy. From this point, two other strategic initiatives stretched the period of e-governance goals to 2010. That said, the nation has not yet sustained a strategic attitude on the matter; thus, the government has not aggressively explored the full range of e-governance possibilities.

However, Slovenia does have a relatively coherent and swiftly adopted legislative framework on security of information, privacy protection, and other aspects of e-communication with the government. The government also adopted binding laws covering internal e-mail communication with citizens, as well as the general use of forms and regular and timely provision of critical information on government Web sites.

EXECUTIVE AND ORGANISATIONAL INITIATIVES

In Slovenia, many different institutions were involved in e- government development and implementation between 2000 and 2004. The Ministry of Information spearheaded the government-wide initiative, thereby centralising e-related action planning and service delivery in one place.

The Project in Brief

Where:

Slovenia

When:

Since 2006

The Project:

The deployment of e-government and e- health services for citizens in Slovenia

Benefits:

- Accessing a greater customer base
- Broadening market reach
- Lowering of entry barrier to new markets and cost of acquiring new customers
- Increasing services to customers
- Enhancing perceived company image
- Gaining competitive advantages
- Potential for increasing customer knowledge

After 2004, the ministry was abolished and its functions were transferred to the Ministries of Public Administration and Higher Education, Science, and Technology.
Although most of the important work on e-governance was completed by 2004 (e-personal income tax, public administration information portal, ministry Webpages, etc.), the new Ministry of Public Administration developed its own electronic form portal. Prior to this, the Ministry of Information had initiated a common template for all ministry Web pages, thus reducing confusion for users when browsing for information across different government agencies.

Today, all ministry Web pages offer contact data; information on mission, programs, and organizational structure; news of current plans and activities; important links; and information on related procurement opportunities, with necessary guidance and e-forms.

CITIZEN-CENTERED E-SERVICES

Slovenian citizens now have a well-developed e-governance framework. First, **they have the right to expect quick responses to e-mail inquiries**—although in practice, not all public institutions meet this standard. Second, **they can send personal income tax forms via secured Web connections**, and many of the forms necessary for different services **can be obtained from agency Web sites and completed at home.** This allows citizens to prepare themselves in advance before visiting a government bureau, enhancing the likelihood that their documents will be processed more efficiently and effectively. Lastly, another example of a 360° e-service transaction is the automobile registration process. Every citizen with access to the Internet can register a car, ensure it, and pay all expenses from the couch at home in just a few minutes.

Despite this seemingly enviable e-governance profile, room for improvement remains. Not all government Web sites are properly organized, some involve unusually long waiting times for receiving a response, and transaction procedures may be unnecessarily complicated for many who are not well informed on the public sector or savvy about using the Internet.

BUSINESS-RELATED E-SERVICES

The Slovenian Web site for businesses is available as a national government sub portal on e-uprava.gov.si/ e-uprava/poslovni.euprava. The main page includes a special application—"e-vem" or one-stop-shop—that enables e-registration for independent entrepreneurs and lists different types of interaction between a private company and government. Still, after getting initial information, users are referred to another Web site (pop-up) for further e-applications. Users can be bounced around through four pop-ups before arriving at the final application to start the desired e- procedure.

Most information available for different types of organizations concerns establishing a business, taxation, employment, accounting, a wide range of particular business process issues, and closing down an organization. Sending annual business reports via Internet applications, paying taxes, announcing job openings on the national e-portal, etc., are also possible. However, many of the e- forms and applications available on the business e-portal are connected with registering the grape crop and licensure for selling homemade wine and other alcoholic fruit drinks. Nevertheless, most applications available to the business community are strongly linked to taxation and reporting business results. This leads us to conclude that the government's main interest in e-service is more in collecting taxes than in providing business-friendly government services aimed at improving company performance and profitability.

E-HEALTH THE ROLE OF PPP IN DEVELOPING E-HEALTH SERVICES

Public Private Partnerships are slowly gaining in importance. Private companies are usually involved in the process of the development of eHealth software. However, the demand, financing and control are still fully in government hands. The companies are responsible for development of the product, part of the investment (according to the agreement) and later for production of the product. The companies involved in PPP are a few Slovenian and foreign companies with strong health-related R&D departments. Companies are usually selected on the basis of a public tender call in the field of research and development (science) or health.

In addition, a vast step forward regarding the PPP legislation was recently taken. The government proposed a new law on public private partnerships, which follows the EU objectives of the Green Paper on Services of Public Interest. The Private Public Partnership Act is expected to encourage private investments (and private building, maintenance and management) of the public infrastructure and to ensure transparency in the field of private-public co-operation. In future, public institutions will have to justify their choice if private institutions are not involved in the accomplishment of a project.

Another proposed act is new Public Procurement Act. This act was proposed to simplify the procedures regarding public procurement. Its objectives are to ensure transparent and faster procedures. The Ministry and representatives of other stakeholders agree that the old procedure slowed down the process of public procurement, including in the field of eHealth.

TECHNICAL BACKGROUND TO PROVIDING E-HEALTH SERVICES

The specifics of the technical background to providing eHealth services in Slovenia are that the level of technological development varies according to the territory involved. While at the local level the technical background is quite well developed, Slovenia lacks a unified and integrated information system at the national level.

- **On the local level**, the main achievements in the past few years were the applications in Slovenian hospitals and outpatient services, which now already have the form of electronic medical records on patients. Health data that are collected and processed include:
  - working and final diagnoses,
  - inpatient procedures,
  - used drugs (medicines) according to the common Slovenian code system of registered drugs,
  - databases of insured persons covered by compulsory and voluntary health insurance,
  - databases of persons liable to pay compulsory insurance contributions,
  - a database of healthcare service providers,
  - registers of selected general practitioners,
  - National codes related to the calculation of the costs of healthcare services.

Moreover, all hospitals collect data on anamnesis and clinical status and prepare a summary of treatment usually in the form of free text or sometimes in structured (formatted) records. In addition to basic health data (diagnosis, medicinal products), hospitals also collect data for outpatient services in a uniform way; these data include risk factors for cardiovascular diseases, preventive gynecological screening and examinations. An increasing number of applications support the monitoring of patients with chronic diseases. Many providers already use electronic waiting lists. Data for hip surgeries is also collected at the national level. Information technology support is in place in most laboratories that exchange data with the information systems in hospitals or outpatient services so that the results of laboratory tests are incorporated in electronic medical records.

- **On the national level**, the development of eHealth used to be relatively slow and poorly coordinated. This resulted in a lack of unified information systems at the national level, which would lay stress on the establishment of a single healthcare information portal. The portal would enable the safe and reliable exchange of information for all stakeholders in the healthcare system and provide electronic services and informing in a single (standardized) and transparent manner. Still, there have been a few successful nationwide eHealth projects. In the 1992-2002 period, under the leadership and

sponsorship of the National Health Insurance Institute, Slovenia successfully implemented the first steps of information technology implementation in the healthcare system with the introduction of basic computer technology and computer exchange of information, the definition of standards, setting up of databases and introduction of the health insurance card system. Although the infrastructure was introduced for the entire healthcare sector, its applications were developed mainly to satisfy the needs of the health insurance and partly also for the needs of those involved in healthcare statistics. The health insurance card system has provided reliable patient and medical professional identification at all levels of the health system and simplified the procedures related to health insurance. Within this system, the 250 largest healthcare locations are connected to the self-service terminal network. This enabled us to achieve a high level of recognition in Europe and our experiences are being used by other states in similar card projects.

8.13 CONCLUSIONS

Europe presents many best practices for broadband services, from the deployment of Wi-Fi connection services in specific touristic areas to the migration of crucial public services (like government o health) into e-services or the deployment of satellite broadband internet access services.

Those practices involve the stimulation of the take-up of broadband infrastructure and the promotion of the networks' roll out through the provision of services.

Investments for the building of broadband infrastructure are the first step in order to bridge the gap of digital divide, but investments for the deployment of broadband services are the necessary final step so that citizens, public servants and organizations could really benefit from new generation broadband services.

Moreover, without a robust digital inclusion strategy to address the digital divide, lower socio-economic groups will face increased marginalization and social exclusion.

In this view, **the importance of broadband deployment also acquires a social value**, linking up tourism to health, public administration services to citizens' needs.

As a result of the best practices of broadband services, **the cost of high-speed broadband services is relative to the large investment in infrastructure that must be recouped by operators**.

In this context, it may be possible to tailor lower-cost broadband products offered to users, bridging the affordability gap of connection and access fees, simply by reducing the cost of providing infrastructure to lower-income groups.

8.14 ANALYSIS OF TRANSFERABILITY

The described good practices have been collected because of their potential for being transferred to different geographic contexts and organizational settings.

Even though they involve different geographic areas, with different local needs and different availability for local investment, they show factors for success not only associated with local context (such as the presence of small municipalities in unattractive areas for ITC providers) but also so general to be replicable elsewhere.

Even if from the survey appears that the most relevant difficulty local administrations encountered during the implementation of infrastructure broadband projects was the lack of expertise in managing ICT projects, **each good practice is technically qualified**, managed thanks to a good sector- specific knowledge of ICT technologies and implementation problems in sometime harsh environments.

Some practices are carried out with the help of strong ICT providers with technical expertise and adequate financial resources.

Others are carried out by means of inhabitants living in areas not served by adequate communication services and with a rooted knowledge of the local area and its needs, eager to create a valuable ICT business system for citizens and SMEs of the area.

Finally, others are carried out thanks to the strong political will and push to redevelop the area by improving ICT services and creating an e-services system, in order to offer a wider demand for supply for citizens and reduce red tape for businesses.

Apart from technical conditions, good practices were successful also because of an ICT ad hoc regulatory and legal framework, with a clear knowledge of ICT regulations and a **strong political support** (for example, the majority of projects were financed through the **European Regional Development Fund**).

KEY FACTORS FOR SUCCESS AND TRANSFERABILITY

The help of European Union by means of EU State Aid for the broadband sector, facilitating well-designed aid targeted at market failure areas

The essential role of Public-Private Partnerships in order to reduce costs of investments for the public, by attracting investors and entrepreneurs

Technical conditions (know-how and qualified ICT expertise, specific human resources)

Clear regulatory and legal framework for ICT sector

Strong political will to push ICT services, creating an e-service system in order to offer a wider demand for supply for citizens and reduce red tape for businesses

Strong regional political support, using the European Regional Development Fund

MAIN DIFFICULTIES AND ISSUES ENCOUNTERED DURING THE IMPLEMENTATION OF PROJECTS

Lack of interest by ICT providers in investing for broadband infrastructure intervention in most deprived areas ("white" areas)

Research for funds and local investors

Lack of qualified technical expertise in the public administration personnel during the implementation of broadband infrastructure projects in some countries

High deployment costs for some broadband infrastructure interventions

Lack of a national Public-Private Partnership legislation (or sometimes unclear ones)

9) FINAL CONCLUSIONS

The Digital Agenda for Europe targets are defined as:

1. 100% of basic broadband availability to European Union citizens by 2013;
2. 100% with 30 Mbps (fast) broadband availability to EU citizens by 2020;
3. 50% with 100 Mbps (ultrafast) subscriber take-up in homes by 2020.

According to the EU Scoreboard, basic broadband coverage is available to over 95% of EU citizens and fast broadband coverage is available to 54%. Yet only 2% of homes within the EU have taken up ultrafast broadband subscriptions, and this is the most relevant statistic.

Therefore, it is beyond question that Europe is facing the issue of digital divide in many of its regions. The reasons why digital divide is so deeply rooted are several.
The first issue is the **lack of understanding of the relevance and benefits of broadband.** Thus, this Guide is intended to provide broadband best practices, showing the benefits and the opportunities for development and modernization of broadband infrastructures and services.

Secondly, the **lack of skills or familiarity with information technologies as well as confidence to use them**, which should be faced with implementations of educational programmes and stimulations of initiatives for the development of e-services, such as e-government, e-health, e-learning or e- business, aimed at encouraging the development and use of new broadband applications.

Last but not least, the **affordability of connection and access fees shaping the levels of broadband penetration.**

Specifically, as it appears in the guide, the gap in digital divide involves the availability of broadband infrastructure usually between densely populated urban areas and sparsely populated rural areas, often due to the diverse technical, geographical and socioeconomic characteristics of different areas, mainly rural and remote, making their take-up unattractive for commercial investment by broadband providers.

For this purpose, the EU is developing broadband policies to address the digital infrastructure divide, by stimulating investment in high-speed broadband infrastructure in rural areas, through the provision of public-private partnerships and structural funds.

Indeed, the majority of best practices showed in this Guide are financed by the involved regions

that provide the access to the EU funds through the European Regional Development Fund, whose aim is to strengthen economic and social cohesion by correcting imbalances between European regions.

The access to EU funds is not the only way to bridge the gap by providing affordable high-speed fiber broadband services, lowing socio-economic groups to offset the investment in fiber infrastructure.
It is increasingly unlikely that public authorities are able to meet any gaps in provision on their own. So it becomes fundamental to gain the support of the private sector, promoting public-private partnerships for interventions and investments in building broadband infrastructures.

Public-private partnerships provide potentially effective solutions. As an alternative method of procurement, PPPs have been successfully already applied in several broadband best practices to meet a range of infrastructure requirements.

Nevertheless, PPPs should not be simply seen as a method of financing. They can provide the public sector with the ability to transfer risk and accelerate the roll out of the necessary infrastructure which service providers require to be in place before they are willing to provide broadband services for retail and business customers.

PPPs have the advantage that the level of private sector involvement and funding commitment can be tailored to meet the specific requirements that exist for a particular region. Moreover, they make it possible to implement projects with the appropriate scope and accelerated pace, ensuring that public funds will be used in the most effective and efficient way while encouraging as much private sector involvement (and especially risk sharing) as possible.

Above all, it is important for a managing public authority to be aware that access to affordable broadband offered by organisations via PPP implies benefits from using the network for its own services, but it has also a positive effect in terms of meeting the most basic needs of the individuals, communities and businesses in a territory.