

Comparative analysis of broadband penetration and digital public services in South East Europe

Konstantinos Antonis^{2,3}, Christos Bouras^{1,2}, Fabrizio D'Elia⁴, Annalisa Di Vincenzo⁴,
Georgios Diles², Vasileios Kokkinos², Andreas Koskeris¹

¹Computer Technology Institute & Press "Diophantus", Patras, Greece

²Computer Engineering and Informatics Dept., Univ. of Patras, Greece

³Technological Institute of Central Greece, Greece

⁴Molise Region, Italy

k_antonis@teiste.gr, bouras@cti.gr, fabrizio.delia@gmail.com, argia78@tin.it,

diles@ceid.upatras.gr, kokkinos@cti.gr, koskeris@westgate.gr

Abstract—Broadband is starting to be deemed by many as a public utility and several countries have already recognized it as a civil right. The European Commission (EC) acknowledging the significance of broadband services for the improvement of citizen welfare and its economic benefits, has put in place targets for the diffusion of broadband to all citizens and businesses in the European Union. This paper, comparatively assesses the current state of affairs in broadband and digital public services in selected South East Europe countries in order to identify weaknesses and highlight strengths and to produce knowledge resources and provide insights that will support informed decision making including strategy and policy planning. It builds on three surveys that took place in the second quarter of 2013 and evidence gathered from seven South East Europe countries.

Keywords—broadband; digital public services; strategy and policy planning; South East Europe;

I. INTRODUCTION

The benefits of broadband on society and the economy have been strenuously researched in the near past and still remain a topic of interest [1]. 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 [2].

Several studies, such as [1] and [3], 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 [4].

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 [5].

The purpose of this paper is to 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.

The rest of the paper is organized as follows: Section II describes the SEE Transnational Cooperation Programme on improved virtual accessibility that ignited the research for this paper, while Section III describes the methodology followed in our research. Section IV presents the results of our analysis as far as broadband is concerned and Section V regarding e-Government services. In Section VI we provide some policy recommendations based on the analysis and in Section VII we conclude the paper and we make suggestions for future work.

II. SIVA PROJECT

The inception of this paper is attributed to project SIVA. SIVA stands for “South East Europe improved virtual accessibility through joint initiatives facilitating the roll-out of broadband networks”. The project aims to contribute to the improvement of the accessibility of SEE through broadband services, as substitute for and supplementing physical accessibility and thus to the narrowing the digital gap in SEE.

In terms of broadband infrastructure and services, SEE area showcases complex and diverse behaviour. There is a large gap in telecommunication infrastructure and broadband access between SEE area and the rest of Europe. There is also a substantial gap among SEE countries and among rural and urban areas of a country. Access to information, however, is a prerequisite for development and competitiveness, and it has been shown that access to information, broadband connectivity and financing of virtual accessibility are key components necessary for the development, adoption and use of Information and Communications Technology (ICT) in the economy and society. Thus, tackling this problem would help improve integration and competitiveness.

SIVA’s initiatives will result to tangible structural long term changes on virtual accessibility strategies in the partners’ territories. Partners’ virtual accessibility and broadband planning strategies will be improved through the foreseen activities as regards the evidence made available on the quality of experience of broadband access, on the most cost-effective technological solutions to expand broadband coverage, and on the cost savings, simplicity and speed of deployment by promoting the sharing of infrastructures.

III. 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.

IV. COMPARATIVE ANALYSIS

A. Broadband offerings in SEE

1) Geographical coverage

This section highlights the geographical coverage of broadband. 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.

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.

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 licence		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 III. SOPHISTICATION LEVEL FOR E-GOVERNMENT SERVICES TO BUSINESSES ACROSS THE SIVA CONSORTIUM COUNTRIES
SOURCE: EPRACTICE.EU, SIVA SURVEY ON DIGITAL PUBLIC SERVICES IN SEE (2013)

Service	Austria	Bulgaria	FYROM	Greece	Italy	Montenegro	Slovenia
Social contributions for employees	4	2	1	2	3	0	4
Corporate tax: declaration, notification	4	2	2	4	3	0	2
VAT: declaration, notification	2	2	0	4	3	0	2
Registration of a new company	1	1	2	2	3	2	2
Submission of data to statistical offices	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

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%

V. 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 [6]. 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.

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 [7], [8], [9]. 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 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.

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.

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.

VI. POLICY RECOMMENDATIONS

According to the Digital Agenda Scoreboard [10], all SIVA countries lag behind the EU average both in terms of broadband population coverage as well as sophistication of e-Government services (Fig. 1). Significant progress on both fronts is urgently required in order to improve virtual accessibility of citizens and businesses.

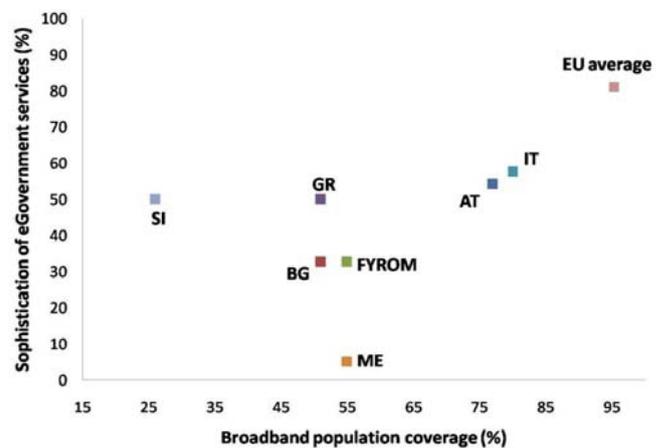


Fig. 1. e-Government sophistication vs. broadband penetration comparative situation in SIVA countries, Sources: SIVA surveys on broadband penetration and digital public services, Digital Agenda Scoreboard.

Moreover, Sections IV and V clearly highlighted that 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 [11]. 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.

VII. CONCLUSIONS AND FUTURE WORK

This report 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.

As a future step, we intent to use this information to further explore the policy landscape in order to propose potential amendments and provide tools that will aid public administrations in bridging the gap in SEE regions.

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