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Full Length Research Paper

Impact of universal service on telecommunications and economic development in emerging economies

Dragan Bogojevic[1]*, Natasa Gospic[2] and Marijana Petrovic[2]

[1]Alcatel-Lucent Pupin Serbia, Batajnicki put 23, Belgrade 11080, Serbia.
[2]Faculty of Traffic and Transportation Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia.

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This paper presents an in-depth analysis of the Universal Service (US) situation in Serbia, addressing the economic and geographic digital divide for the introduction of broadband services. The authors' main objectives are to study and present a detailed overview of the state of telecom infrastructure and telecom service provisioning in the whole territory of Serbia as well as to recommend basic elements for appropriate broadband access policies for regions as administrative units. The study methodology includes the situation of locations (settlements) without fixed telecom services and locations with low penetration (4 and 10%), with each settlement having more than 50 inhabitants or more than 20 households. To facilitate implementation, the economic strength of the critical settlements and the necessary US funds are estimated, and the relationship between economic and telecommunication development is evaluated on the level of Serbian municipalities. This relationship indicates to policy makers that telecommunication is an important tool for overall development. Special attention is paid to people with disabilities and low-income users. As Serbia belongs to a large class of medium countries with a middle income and moderate telecommunications, this case study and its findings could be used as a model for other emerging economies.

Key words: Telecommunications and economical development, universal services policy, broadband access, people with disabilities, telecommunications policy makers, emerging economies.

INTRODUCTION

Countries are working to design, formulate, plan and implement public telecommunication policies with the aim of narrowing the digital divide. To that end, they have established policies, such as universal telecommunication service, which is intended to reach neglected geographical areas and to introduce telecommunication infrastructure that is able to provide a greater number of services under better conditions and without being geographically dependent on one another.

In developed countries, universal service (US) is practically implemented, and the focus is redirected to broadband development in rural areas (such as in Korea, America and Europe) where considerable financial resources are invested in its implementation. Currently, in rural areas of the EU, an average of only 70% of the population can access a broadband network connection. The Reform announced in 2009 that it will help in overcoming this "digital divide" by better managing the radio spectrum and by making wireless broadband services available in regions where building a new fiber infrastructure is too costly; it will also allow EU member states to expand universal service provisions beyond narrow-band internet access. It is obvious that the universal service policy is a crucial part of the telecom-munication development policy. Today, in general, the traditional approach to universal service/access is becoming nearly obsolete, and broadband services are increasingly considered to be a part of the US definition.

Therefore, in this paper, the authors present their views on the methodologies by which the basic elements of the Universal Service policy should be set within the national regulatory framework. The methodology is based on the

*Corresponding author. E-mail: drbogy@gmail.com.

development of a database that was formed by collecting detailed data on the level of implementation of universal service in every settlement in the country, as well as the development of a database on critical settlements, municipalities and regions, with three levels of criticality. Later, these databases can be used for the monitoring of US deployment. Data regarding people with disabilities and special needs are also prepared and discussed. Using this methodology, the authors analyzed the overall situation of telecom development in Serbia.

Serbia belongs to a large group of medium countries with a middle income and moderate telecommunications. Serbia is a good representative of typical developing countries. The authors believe that this case study, coupled with Serbian telecommunications data, could be used as a model for many developing countries that are in the early stages of US implementation or in the process of revising their US policies toward broadband.

LITERATURE REVIEW

Universal service has been the subject of many studies by international organizations, institutions, and international and national experts. The International Telecommunication Union (ITU) has a leading role in US policy recommendations (ITU-D Report on US, 2009). The importance of appropriate US regulation is emphasized by EU directive 2002/22, where the scope of universal service is defined as the connection to the public telephone network at a fixed location (that is capable of supplying "functional Internet access" that is currently limited to a single narrowband network connection); having access to publicly available telephone services (including geographical averaging of retail prices and social tariffs); and the existence of directories and directory enquiry services, public pay telephones, and special measures for people with disabilities. Many authors discussed geographical accessibility (Milne, 2002; Jayakar and Sawhney, 2004; Kenny and Keremane, 2007), while others (Elwan, 1999; Yeo and Moore, 2003) dealt with US impacts on persons with disabilities.

On the other hand, few papers have addressed the particular needs of people from developing countries, countries with economies in transition or the least developed countries. Internationally agreed upon development goals, including those in the Millennium Declaration and the World Summit of Information Society (WSIS) 'Geneva Plan of Action and Tunis Commitment and Agenda for Information Society' (WSIS Tunis 2005) require that the focus should be on those countries. Indicative 'targets were established to be achieved by 2015; one of the targets is "improving connectivity and universal, ubiquitous, equitable, non-discriminatory and affordable access to, and use of, ICTs, considering different national circumstances, to be achieved by "2015".

In Europe, Southeastern European (SEE) countries with emerging economies and economies in transition are monitored by Cullen Int. (2009). Twice per year, the region is analyzed with respect to regulatory and market developments in telecommunications. The first analysis of US was done in the Study on Universal Service in the accession countries (Cullen, 2001). Cullen Int. continues monitoring US and usually provides information about the scope of universal service, the provider designation mechanism, and the technology neutrality of the US obligation, and they examine the universal service funding and quality of service for Albania, Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, Serbia and Turkey. Despite the consistent monitoring and attention, a US funding mechanism for compensation is not implemented, and practical US realization is unsatisfactory and mostly described in general terms.

We found that, especially in emerging economies, the data regarding how many villages have basic access to telecommunication services or the realization of US service in practice are not available in the reference literature, especially for medium and small countries (population under 10 million) with middle to low-income, according to the World Bank categorization. The authors discussed those issues in Gospic and Bogojevic (2008, 2009; 2010) and Petrovic et al. (2009).

GENERAL DATA ABOUT TELECOMMUNICATIONS IN SERBIA

Serbia is centrally situated in Southeastern Europe (SEE), and its economy is in a transitional process. It is one of the largest countries in SEE, with more than 7.5 million inhabitants (without Kosovo and Metohija). The volume indices of GDP per capita in PPPs (expressed in relation to EU = 100) in Serbia are at a level that is substantially below the EU average (33, 36 and 36% for years 2006, 2007 and 2008, respectively). Telecommunication in Serbia is lagging behind EU countries, not only in technology development but also in regulatory development. In Serbia, two fixed operators were licensed and three mobile operators have licenses for GSM and UMTS. More than 180 ISPs have permission to provide Internet services, and more than 75 cable operators have permission to provide TV and Internet services. The Republic Regulatory Agency for Telecommunications (RATEL) was established at the end of 2005. Table 1 illustrates progress in the development of telecom service subscribers over the period of 2006 - 2008 (RATEL, 2009).

Although the figures in Table 1 show consistent growth, broadband penetration is still low. According to a RATEL annual report (RATEL, 2009), the broadband penetration rate (the overall number of broadband lines divided by the national population) at the end of 2008 was 6.6% (without UMTS subscribers). This is significantly below

Table 1. Comparative overview of the number of telecom service subscribers.

Telecom service	2006		2007		2008	
	Number of subscribers (thousand)	Penetration (%)	Number of subscribers (thousand)	Penetration (%)	Number of subscribers (thousand)	Penetration (%)
Fixed	2,719.40	36.30	2,854.50	38.00	3,084.87	41.14
Mobile	6,643.70	88.60	8,452.60	112.70	9,618.77	128.27
Internet	1,005.00	13.40	1,268.50	16.90	1,619.71	21.60
Cable	541.90	7.20	774.10	10.30	860.79	11.48
Broadband	112.90	1.51	258.40	3.45	493,784	6.59

Sources: RATEL, 2009; Jankovic and Radunovic, 2008.

the EU-27 average rate (22.90%) (Cullen International, 2009).

As shown in Table 1, there has been significant growth in the mobile penetration rate due to the existence of competition. In terms of mobile broadband, Serbia had 10% of the active UMTS but only 0.4% of them were mobile Internet subscribers (RATEL, 2009). All of the figures indicate that there is a potential for future development if it is driven and accelerated by adequate telecommunication development.

In terms of organizational responsibilities (Telecom Act, 2003), the Ministry defines the set of universal services to be provided by operators of the public telecommunications networks based on a proposal by the RATEL. The RATEL also designates the telecommunication operator(s) that are responsible for providing US. An integral element of the US strategy is the establishment of a fund for US cost recovery.

On the basis of the Telecom Act, the incumbent operator Telecom Serbia was the US operator for a period that was not longer than the period of its exclusivity rights, which expired in June 2005. In March 2010, after issuing a second license for fixed telephony, RATEL designated that all of the fixed, mobile and CDMA operators (Telekom Serbia, Telenor, VIP mobile and Media Works) will be operators with universal service obligations. Universal service operators will be obliged to provide services set by the universal service obligation in the whole territory of the Republic of Serbia (that is, in the area determined by the issued license). US operators have the right to the reimbursement of costs for the provision of the stipulated services. The obligations for operators will become effective in the second half of 2010.

APPLIED METHODOLOGY

Here, we propose methodologies for defining the basic elements in the creation of US policy by conducting a composite study to obtain information with quantitative and qualitative data pertaining to the implementation of the public policy of which the impact is to be measured. This approach is tested in practice by the project initiated by the Regulatory Agency for Telecommunications, public discussion on US policy and in the literature (Gospic and Bogojevic, 2008, 2009; Petrovic et al., 2009; Bakmaz et al., 2008). The methodology is focused on critical places (settlements with inhabitants), which are considered to be places without fixed telecom services (0% penetration) and places with low penetration (4 and 10%) in any settlement having more than 50 inhabitants or more than 20 households. The research was divided into two steps.

The first step encompassed the collection of the basic demographic and economic data sets (population, age profile, employment, economy, etc.), existing telecom services, the level of US and other information about each settlement to create different databases. The research was based on the administrative territorial division of Serbia into three hierarchical levels: Region, municipality and settlement. In accordance with the administrative division of the Republic of Serbia (without Kosovo and Metohia), Serbia is divided into 24 regions and the City of Belgrade, 161 municipalities, and 4,715 settlements, with 7,498,001 inhabitants and 2,521,190 households (Census, 2002).

By importing the telecom statistics data at each level of territorial division, the databases were created as follows:

1. Database with statistics on the settlements level
2. Database with statistics on municipalities where US is critical
3. Database with statistics on the regions where US is critical

For the database with statistics on the settlements level, the following data were chosen:

1. Number of inhabitants
2. Index of number of inhabitants (based on censuses 2002/1991)
3. Number of households
4. Number of fixed phones
5. Teledensity (number of phones per 100 inhabitants as percentages)
6. Mobile signal coverage
7. Internet access

The number of fixed phones was determined using available data from the incumbent operator Telecom Serbia, the fixed network operator, and available Directories.

The following data were chosen for the database according to the statistics of the regions and municipalities to represent the situation:

1. Number of settlements and number of inhabitants without fixed telephones.
2. Number of settlements and number of inhabitants where US should be realized.
3. Number of settlements and number of inhabitants with a telephone penetration of less than 4%.

Table 2. Survey of critical places and inhabitants for realization of US in Serbia, 2007 - 2010.

Year	Universal Service		Without fixed phones		Penetration up to 4%		Penetration up to 10%	
	Places	Inhabitants	Places	Inhabitants	Places	Inhabitants	Places	Inhabitants
November 2007	696	151573	921	156816	1122	245010	1344	385886
% of all	14.80	2.00	19.50	2.10	23.80	3.30	28.50	5.15
June 2008	637	130,908	844	135,866	1,022	210,835	1,233	323,981
% of all	13.50	1.70	17.90	1.80	21.70	2.80	26.20	4.32
January 2010	493	101,765	677	107,423	834	170,984	1,030	270,196
% of all	10.46	1.36	14.36	1.43	17.69	2.28	21.85	3.60

Sources: Gospic and Bogojevic (2008); Bogojevic (2010).

4. Number of settlements and number of inhabitants with a telephone penetration of less than 10%.

Those data from the previously mentioned databases offer necessary information about the total number of municipalities containing settlements without fixed telephones, and the number of settlements with penetrations between 4 and 10% (Table 2). A list of critical municipalities and the most critical regions is identified as well. The results show that a geographical concentration of places, municipalities and regions without fixed telephony exists.

In order to verify the data obtained from the first step of analysis, the field research was performed as a second step of the applied methodology. For the field research, questionnaires containing 15 questions were created. The questions were related to demographic, economic and telecom development in the observed settlements and included: (1) Number of inhabitants; (2) Number of households; (3) Mean age of population; (4) Number of fixed phones; (5) Nearest phone (in km) if the settlement has no fixed phones; (6) Nearest public pay phones if the settlement has no fixed phones; (7) Number of current applications for fixed phones (waiting list); (8) Existing/planned telecom services; (9) Mobile signal coverage; (10) Internet access; (11) Usage and number of PCs; (12) Economic development; (13) Number of people with special needs; (14) Beneficiaries of social help; and (15) Presence of a school, post office, local community office, or ambulance in the settlement.

The research was performed in sampled locations in 13 regions and the City of Belgrade as well as 40 municipalities, with a total number of 253 settlements that all had a fixed phone penetration of less than 10%. This set of settlements is divided into two subsets. One subset contained a group of settlements where the presence of researchers in the field was required (63%), and another subset contained settlements where information was gathered by phone (13%) or other means by contacting inhabitants or representatives in neighboring places (24%). The obtained data was compared with the data from the first phase (answers on questions 1, 2, 4, 9 and 10 are compared with the database on the settlement level).

ANALYSES OF RESULTS

After analyzing and summing up the results obtained in the research, the following could be concluded:

Critical US settlements, municipalities and regions in Serbia

The survey of critical places in Serbia is presented in Table 2. The table shows the numbers of places and numbers of inhabitants at different levels of observation: without fixed phones, with a fixed penetration of less than 4% and with a fixed penetration of less than 10%. Also, the percentage of these places and inhabitants as a percentage of the total number of places and inhabitants is given for November 2007, June 2008 and January 2010.

Based on Bogojevic (2010), in Serbia in January 2010, 1.43% of the population in 14.36% of the total number of settlements did not have a fixed telephone, while 3.6% of the population in about 22% of the settlements had penetration below 10%. A survey of places without fixed phones in regions in Serbia, along with the number of inhabitants and the number of households, showed that in two regions (Pcinjski and Jablanicki), 51% of all places and 59% of all inhabitants did not have a fixed phone.

It is clear that a geographical concentration of places, municipalities and regions without fixed telephone access exists. This conclusion could help in proposing new methods for US implementation and US operator(s) selection. The average number of 51 users in 677 places without phones in Serbia clearly indicates that a large investment is required if these customers are going to be connected using copper cable technologies. The data indicate that other technologies should be considered, with mobile as a first option.

Fixed mobile substitution

Mobile networks are often seen as an alternative to wired networks for US (Burkart, 2007; Kenny and Keremane, 2007). Based on data from two mobile operators, we analyzed the mobile network coverage in settlements without fixed phones and obtained the following results: approximately 75% of settlements without fixed phones have a mobile network signal, and more than 33% of settlements have signal from both mobile operators. Approximately 25% of the places without fixed phones have no mobile signal of appropriate quality, 15% have no signal at all and 10% are partially covered.

Evidently, fixed mobile substitution is partially realized, and one conclusion could be that mobile networks can be

an alternative option for the realization of US. However, as “universality” requires service with affordable prices, US policy must answer the following questions:

1. Should infrastructure expansion/construction be subsidized by the US fund?
2. Should customers receive financial support to use mobile telephony, with a special tariff package based on the price of fixed telephony?
3. How can usage of functional Internet/broadband access through mobile networks be ensured, and should this usage be subsidized by the US fund?

The introduction of mobility for US is a complex problem, but in the case of Serbia, it could optimize the value of the requested investment.

Personal computers and Internet

The data regarding the usage of personal computers and the Internet were gathered by screening 253 settlements with less than 10% fixed phone penetration.

The results regarding the usage and the number of personal computers (PCs) revealed that in 44% of the settlements, there are no computers, and in an additional 12% of the settlements, no one had ever used a computer. Based on the estimated number of computers, the penetration is 3.5 computers per 100 inhabitants and 10 per 100 households. However, a few settlements (in suburban areas) had computer penetration levels that were equal to the average rate in Serbia. Without these places, the penetration level is only 2 computers per 100 inhabitants.

For Internet usage in critical settlements with fixed phone penetration values that were less than 10%, we obtained similar results. Approximately 58% of the settlements have no Internet access, and 35% have dial-up connections. In 7% of the settlements, there is some kind of broadband access (dial-up and ADSL or ADSL and GPRS), mostly in suburban places where data from the National Statistical Office differs from that provided by the fixed operator.

Scenarios for US policy

The proposed methodology offers a detailed overview of the telecom development situation in the entire territory of Serbia. Considering the results of this study, the country’s commitments toward the approved eSEE Agenda plus, and the EU Directive on US 2002/22, the following scenarios for US policy should be considered:

Scenario A

The US should include the set of services defined in the Telecom Act (part 1), with additional service for functional Internet (European Union, 2002) and broadband access for schools (eSEE+, 2007) and institutions for people with disabilities, to be realized before the end of 2010.

Scenario B

The US policy should be defined such that, depending on the development status of a region and the local authorities’ plan and initiative, different sets of services are to be included. This means that broadband services should be included for all regions containing less than 50 places without fixed phones (7 regions). In other regions, Scenario A should be applied. This scenario will enable users from the first group of regions to receive broadband access in six months, at the latest, after this request, on a technologically neutral basis and at an affordable price.

Scenario C

This scenario encompasses Scenario A and Scenario B for broadband services in the following way: In 2010, the application of Scenario A should occur in all regions; beyond 2011, the application of Scenario B with broadband services should be included in the US for all regions.

The role of policy makers is to decide which scenario is the most appropriate for the country. Telecommunications policies typically set the objective of providing affordable communications to all citizens and to achieve regional equity, or balance, in the development of networks and services. In the case of Serbia, it is obvious that Scenario A is most liked by the existing operators, who will receive compensation from the US fund and will not be under pressure to install broadband access for customers. Scenario B permits local initiatives and faster development of broadband infrastructure in that part of the country. The main constraint of this scenario is the unequal approach to regions, which can produce political problems. Scenario C, introducing broadband as a part of US in the near future, is the most promising scenario. It will support faster broadband development and migration to NGN (Next Generation Networks) as well as robust telecom infrastructure for new services. Furthermore, it will promote the regional spread of Internet services and stimulate demand, which in turn may increase the demand for broadband. On the other hand, broadband policies use a range of regulatory and fiscal options to reduce costs and facilitate broadband network investment, which in turn facilitate better access at lower prices.

Economic development of critical settlements and US costs per region

Economic development of settlements is not a statistical

category, and the data do not exist. To estimate economic development in critical settlements with that have less than 10% fixed phone penetration, one question in the Questionnaires was dedicated to this issue. The settlement is evaluated with a score from 1 to 5 points (1 for very low and 5 for acceptable economical development). The average score for economic development of all of the interviewed places was 2.01.

Keeping these results in mind, the solution for broadband access is an open question. New technologies, especially 3G networks, represent one of the possible solutions. Unfortunately, a concrete obligation to cover rural settlements does not exist in the licenses that are issued to mobile operators. Furthermore, additional coverage of settlements with elementary schools demands separate regulation on tariff packages for US.

In order to start the US fund, it was necessary to calculate the CAPEX of each region. For this purpose, appropriate technologies for US realization in the regions were suggested. In principle, technologies were proposed using different US examples from different countries and using Delphi methods that were performed by telecom experts. In addition, an attempt to develop a general approach using fuzzy logic was successfully carried out (Bakmaz et al., 2008). Within this study, it is shown that the number of users, under US policy, could be calculated as the number of households. This leads to a rough estimate for the US fund of €34 million, excluding the cost of USs for people with disabilities and low-income users. The estimation of the funds that are required for implementation of Universal Service was given for each region. The results indicate that the majority of funds (more than 50%) are needed for the implementation of Universal Service in two districts: Pcinjski and Jablanicki.

US policy for people with a disability and low-income users

This study also examines special features of the US that were designed for the benefit of underprivileged people, in terms of special tariff packages and ICT solutions that meet their needs and suit their abilities. The focus social groups of the research were people with disabilities and low-income households.

Acts pertaining to the fields of telecommunications, and electronic communications in general (European Union, 2002; Telecom Act, 2006), as indispensable elements of USs include certain measures that are intended to provide people with disabilities and low-income users with viable access to telecommunications services.

The issues concerning the contents of the special features of the US designed for the benefit of underprivileged people are analyzed using the concepts of the US and Universal Access (UA), which are widely considered to have three essential components: Availability, accessibility and affordability (Milne, 2002; Jayakar and Sawhney, 2004). We also mention this approach in the context of a three-dimensional Universal Service: A geographic dimension (geographic availability of the service), a dimension of distributional equity (the accessibility and affordability of telecommunications services in the population of low-income users) and a disability dimension (accessibility, usability and affordability of the service in the disabled population). Our focus was on accessibility and affordability. The availability component does not need to be analyzed separately because one of the key features of the US is to provide the basic scope of the service throughout the territory. The accessibility component implies that users with disabilities can readily avail themselves of the necessary equipment (special equipment, devices, etc.) to meet their needs and suit their abilities.

Research into the social statuses and needs of people with disabilities in Serbia indicates that there is a lack of adequate technical and organizational (administrative) solutions. In order to secure the availability of services, thus incorporating the accessibility component, the procedures for obtaining special telecommunications equipment for the disabled need to be defined in the special features of the US, and the US operator must take on the obligation of devising special modes of payment in the purchase of the equipment. With regard to the public phone booth system, the accessibility component is also to be reflected in the design, placement, and installation of payphones and the surrounding area, as well as in the domain of Internet access, through the implementation of the Web Accessibility Initiative guidelines (WAI guidelines). The latest Report on situation of persons with disability in Serbia (Tatic, 2007) pointed out that there is not enough implementation of web accessibility standards (only a few public web sites can be used with “Enreader” software, but they are not in accordance with WAI guidelines). The Serbian National Information Technology and Internet Agency (NITIA), with help from the United Nations Development Programme (UNDP), started a project in 2008 to improve the accessibility of electronic content and services, and it issued a document titled “Guidelines for making the public authority web sites accessible v2.0”. Because only Article 5 of the Act on Public Information, in a generalized way, guarantees access to information for people with disabilities, special features of the US should be defined in a way that ensures the compliance of public authorities’ web sites to WAI guidelines.

The affordability component, as part of the special features of the US, implies that people with disabilities and low-income users are to be entitled to special tariffs. Affordability is a consideration that is equally important to both the user (purchasing capacity, income) and the state (the fund allocated for the US). Disability has often been associated with poverty (Yeo and Moore, 2003; Elwan, 1999). There is a consensus that one out of ten

inhabitants in developing countries has some sort of disability, and that one fifth of the poverty-stricken population in developing countries suffers from a disability (Braithwite and Mont, 2008). The special tariffs models may differ in terms of the services they cover and the categories of users (that is, the categories of social deprivation that they have been devised for). Here, we examined five models for three different sets of services and two types of user groups (residential and business, consisting of different social population groups).

In Serbia, it is extremely difficult to establish the actual number of underprivileged users, especially the number of those with disabilities because there is inconsistency in the definition of disability. The estimated number of potential residential users who are entitled to the service as people with disabilities ranges from 400,000 to 800,000; in the cases of deprived people, the estimated figure is somewhere between 50,000 and 350,000, and in the case of institutions, it is between 16 and 487. The existing public utilities in Serbia (electricity, television, etc.) require that the population groups that claim rights to these benefits be precisely determined within the framework of the relevant legislation (for example, the 2005 Radio Diffusion Act, paragraph 82). The categories are mainly comprised of people with total invalidity (vision, hearing, muscular strength, etc.); people with disabilities who are welfare beneficiaries; families with disabled children and households whose aggregate monthly income does not exceed the poverty threshold. All of these potential users encompass a total of 170,000 people. The optimal number of included institutions is 43; these comprise accommodation facilities for disabled people (including institutions for people with mental disorders) and children's institutions.

Special tariffs proposed in the study included:

1. In fixed telephony: A 50% monthly subscription fee and 300 free pulses for residential users, and a 50% fee and 600 free pulses for business users;
2. In broadband access: A 50% monthly subscription fee for residential users (100% for business users) for broadband ADSL internet access.

In this case, a rough estimate of the annual expenses is €5.1 million. These expenses do not include one-time installation costs in the cases of users without any access. The amount of subsidy in mobile telephony based on the existing special tariffs, accounts for almost 50% of the total expenses per year and should therefore be allocated solely to the territories in which there is no available fixed telephony. The calculated costs constitute 34.72% of the estimated worth of the US fund. The worth of the US fund was estimated based on the World Bank recommendation, which is 1% of the total telecommunications market turnover (World Bank, 2002; RATEL, 2008). For example, in 2004, Hungary allocated €12 million for the benefit of the underprivileged classes of society. According to the Australian Communication Authority (ACA, 1999), the government provided three million dollars to support innovative projects to help people with disabilities gain adequate access to online information and communications services (hardware or software interfaces, specialized training or support, no subsidy included). Romania's Regulatory Agency (ANRC) invested 35% of the US funds in subsidies to households living below the poverty threshold, so that they could cover the costs of fixed telephony (Milne, 2006).

RELATIONSHIP BETWEEN ECONOMIC AND TELECOM DEVELOPMENT

Despite the existing literature and the strenuous efforts by many scholars to equivocal about the parallel relationship between telecom deployment and economic growth, we found the following data in Serbia.

The rate of economic development on the municipality level was defined using the following data:

1. National income in local currency (RSD).
2. National income per inhabitant, and in relation to the Republic's level.
3. Wages in RSD, and the percentage in relation to the Republic's level.
4. Number of employed and unemployed people.
5. Rate of employed people per 1000 inhabitants.

In order to analyze the relationship between economic development and telecom deployment for all municipalities in Serbia, we calculated Pearson product-moment correlation coefficient (PMCC) between levels of municipality's income per capita (a level of 100 represents the country's average national income per capita) and levels of municipality's phones (a level of 100 represents the country's average number of telecom subscriber per 100 inhabitants). PMCC is calculated using MS Excel statistical software. This is illustrated in Figure 1.

When analyzing the results shown in Figure 1, it is obvious that there are many municipalities with levels of national income and a number of telephones below the national average, and only a few that are above it. Those municipalities above the national average (10 out of 25) are big cities, and two smaller but developed municipalities. In total, 107 out of 161 municipalities have levels of telephones and national income that are below the country average, and they are considered to be municipalities with no adequate telecom infrastructure.

The obtained correlation coefficient for all of the 161 Serbian municipalities was 0.7955, which shows that economic and telecom developments are closely related. Chakraborty and Nandi (2003) obtained similar results.

They found a high positive correlation between tele-density rates and a variety of indices of economic growth.

In order to further examine the correlation between

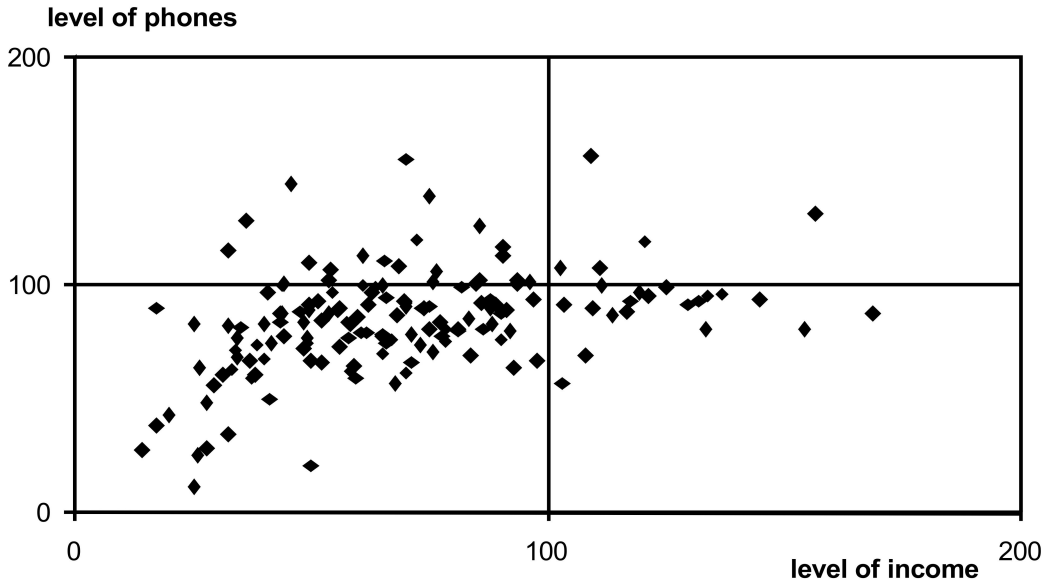

Figure 1. Relationship between telephone penetration and national income on the municipality level.

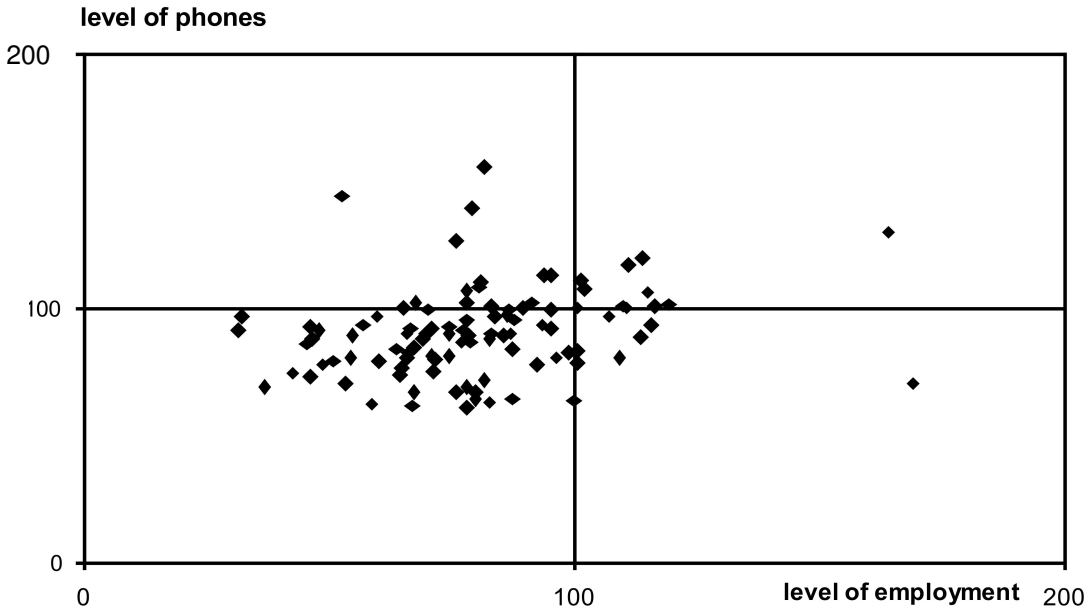

Figure 2. Relationship between levels of telephone density and employment in municipalities in Serbia.

economic and telecom development, PMCC between employment and telecom development is calculated too. For this calculation data sets on the number of employed people (number of employed people per 1000 inhabitants, a level of 100 represents country's average) and telecommunication density (number of telecom subscriber per 100 inhabitants, a level of 100 represents country's average) in all 161 municipalities in Serbia are used. The obtained correlation coefficient in this case was 0.7915 imposing a strong correlation between the rate of employment and telecommunication development (Figure 2).

Municipality correlations in the period of 1999 – 2005

To analyze the above correlations during the period when intensive telecommunications development began, we computed correlations between the same parameters, (that is, the level of national income per municipality, the

Table 3. Correlations among income, employment and fixed penetration for the period 1999 - 2005.

Year	1999	2000	2001	2002	2003	2004	2005
Income : Fixed phone	0.7173	0.7381	0.6694	0.7248	0.7604	0.7628	0.7955
Employment : Fixed phone	0.7336	0.7205	0.7280	0.7059	0.7558	0.7633	0.7915
Fixed phone penetration (%)	28.2	29.2	29.8	30.7	32.1	33.1	35.6

level of employment per municipality and telephone penetration) over a period of seven years (1999 - 2005).

From Table 3, we can conclude that the correlation coefficients for both the levels of national income and employment with the level of fixed telephony development increased during the period from 1999 - 2005. The reason for this trend is very simple: The incumbent fixed operator invested more in large cities and in places where people, usually employed subscribers, could pay more for telephone service, and as penetration became higher, the correlations became higher as well.

Conclusion

Based on the methodologies proposed in this paper, a database of all of the 4715 populated places in Serbia with information on the penetration of fixed, mobile telephony signal coverage and internet was created. In particular, 1030 places without fixed phones and with three levels of criticality (penetration of 0 to 4% and up to 10%) were identified as well as the most critical municipalities and regions in Serbia**.** It is evident that the obtained results enable access to a significant database of panel data (cross-sectional, plus three years of time-series observations). It may be possible to do more sophisticated multivariate analyses with the available data. This will enable us to identify whether or not government policy played a significant role in increasing ICT penetration, and if so, in which regions.

Theoretical and field research has shown that there are high concentrations of US settlements in several regions. The two most critical regions had 51% of all places without fixed phones, and 59% of all inhabitants who live in these places requested more than 50% of the estimated €34 M for the US fund.

The success of any US policy is dependent upon political support at the highest level. Deciding which scenario is best suited to economic and political development will require further discussion. The proposed Scenario B recognizes the differences between different regions and could have political implications. However, if US policy is not promoted for broadband services, then the goal of an Information Society will be far away. Scenario C may fit better in the existing situation, but will prolong rapid achievement of broadband access.

The implementation of USs and the Serbian determination to join the EU and to be a part of the global information society are closely related, and the convergence of these goals will create access to new electronic services for all people. The relationship between economic and telecommunications development indicates to policy makers that telecommunication is an important tool for overall development. This means that proper US solutions can speed up the economic development of critical regions. It is extremely important for administrations to have a methodology that enables them to identify those factors that may have a bearing on the success of telecommunication policies and to measure the social impact they generate in order to make appropriate and timely decisions to guarantee that the action taken is effective.

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REFERENCES

Australian Communications Authority (1999). Consumer Bulletin - Improving online access for people with a disability. Available: http://www.acma.gov.au.

Bakmaz B, Gospic N, Bogojevic D, Davidovic M (2008). Selection of Appropriate Technologies for Universal Service. Proceedings of XLIII ICEST Conference, Nis, Serbia, June 2008.

Bogojevic D (2010). Survey of critical places and inhabitants for realization of US in Serbia. Belgrade, Serbia, 2010.

Braithwaite J, Mont D (2008). Disability and Poverty: A Survey of World Bank Poverty Assessments and Implications. SP Discussion Paper, 0805. The World Bank.

Burkart P (2007). Moving targets: Introducing mobility into universal service obligations. Telecommunications Policy, 31: 164–178.

Cullen International (2001). Study on Universal Service in the accession countries – 2001, Available: http://www.cullen-international.com/cullen/cipublic/studies/usoexecs.pdf.

Cullen International (2009). Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries- Report II. Available: http://www.cullen-international.com.

Chakraborty C., Nandi B (2003). Privatization, telecommunications and growth in selected Asian countries: An econometric analysis. Comm. Strat., 52: 31–47.

Elwan A (1999). Poverty and Disability: A Survey of the Literature. *SP Discussion Paper, 9932*, The World Bank eSEE Agenda plus for the Development of Information Society in SEE 2007 – 2012 (2007). Available: http://www.mtid.sr.gov.rs.

European Union (2002). Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive). Available: http://ec.europa.eu.

ITU-D Report on US (2009). Draft report on Question 7-2/1 Regulatory policies on universal access to broadband services, January 2009, http://www.itu.int/md/D06-RGQ07.2.1-C-0020/en

Jankovic M, Radunovic J (2008). Regulation of the Telecommunication Market in the Republic of Serbia: Start-up. *IEEE* Global Communications Newsletter, 2-6. Available: http://www.comsoc.org/pubs/gcn/.

Jayakar PK, Sawhney H (2004). Universal service: beyond established practice to possibility space. Telecommunications Policy, 28: 339-357.

Kenny C, Keremane R (2007). Toward universal telephone access: Market progress and progress beyond the market. Telecommunications Policy, 31: 155–163.

Milne C (2006). Telecoms demand: measures for improving affordability in developing countries. London, Media@lse. Available: http://www.regulateonline.org.

RATEL (2009). An Overview of Telecom Market in the Republic of Serbia in 2008, RATEL, 2009.

Gospic N, Bogojevic D (2008). Elements of Universal Service Policy. Proceedings of XXVI POSTEL Symposium, pages 3-14, Belgrade, Dec. 2008 (in Serbian).

Gospic N, Bogojevic D (2009). Universal Service in NGN era. ITU Regional Workshop on NGN. Cairo, Egypt, Dec. 2009. Available www.itu.int/ITU-D/arb/ARO/2009/.../Doc11-US_and_NGN.ppt

Gospic N, Bogojevic D (2010). Urban and Rural Telecommunications Development: Identification of a Digital/Broadband Gap in Serbia, IEEE Global Communications Newsletter, July 2010.

Petrovic M, Gospic N, Bogojevic D, Bakmaz B (2009). Universal Service for Socially Excluded Users. Telfor J., 1(1): 30-33, Belgrade.

Tatic D (2007). Report on situation of persons with disability in Serbia. Center for independed living of people with disabilities of Serbia & European Disability Forum, Available: http://www.cilsrbija.org.

Telecom Act (2003). Republic of Serbia Official Gazette, 44/03, Belgrade.

World Bank (2002). Telecommunications and Information Services for the Poor: Toward a Strategy for Universal Access. Discussion Paper, pp. 432, 93.

WSIS Tunis (2005). www.itu.int/wsis/

Yeo R, Moore K (2003). Including Disabled People in Poverty Reduction Work: Nothing About Us, Without Us. World Dev., 31 (3): 571-590.