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GUIDELINES FOR EXPANSION OF BROADBAND INTERNET ACCESS IN RURAL CROATIA

ABSTRACT

Broadband Internet access involves transfer of large data at high speeds, and at the same time the proliferation of new services. Rural areas, for a number of particularities such as the population size, geographical dispersion and lack of commercial attractiveness are often areas of limited availability of broadband access. This paper presents the objectives that must be met in order to minimize the evident differences when compared to urban areas. By achieving the above-mentioned objectives, the country could potentially realise direct (GDP increase) and indirect benefits. In addition to the already existing Strategy for Broadband Development in the Republic of Croatia within the period from 2012 to 2015, it is necessary to continuously harmonize with the determinants of Digital Agenda for Europe. Through strategically planned investments for the implementation of new information and communication infrastructure, and the improvement and modernization of existing ones, it's imperative to gradually increase the availability of broadband access, regardless of geographic area.

KEY WORDS

Broadband access, Internet, Rural areas, Guidelines

1. INTRODUCTION

Broadband Internet access is seen as one of the development indicators of a country, its economy and society in general. The level of Internet use within a certain country (especially broadband Internet access) is proportional in relation to its economic strength and overall quality of life. Some statistics show that the economically stable and advanced countries are fully aware of the modern information society based on online communication. An efficient and high-speed Internet access serves as the basis of Internet communication.

Furthermore, the existing differences in Internet use and in its very approach are noticeable within a country. This statement is particularly obvious in the case of Republic of Croatia. Generally speaking, it is possible to conclude that the development of broadband Internet access within the Republic of Croatia, to a greater or lesser extent, is lagging behind urban areas. It is understandable that countries tend to eliminate the differences between some of their parts, as well as in the segment of Internet access.

The main objective of this strategy is to create all necessary preconditions for accelerated expansion of broadband infrastructure and services requiring high-speed access. This will enable further development of the information and knowledge-based society, and ensure availability of broadband access services under equivalent conditions in the entire territory of the Republic of Croatia. The crucial point is to encourage local authorities to implement various activities, with the purpose of expansion of broadband Internet in areas without any commercial interest (islands, mountainous and rural areas).

By joining the European Union (EU), it is important for Croatia to harmonize its existing regulations and guidelines with those of the EU. The determinants of the Digital Agenda for Europe (one of the European Commission planned documents adopted within the Europe 2020 strategy) are related to: Broadband Internet access and its expansion status in Croatia up to 2011, as well as the expected state-level economic impacts.

The systematic implementation of proposed measures is required, in order to achieve the main objectives, such as to provide basic access to 100 % of the population, to form a single digital market, increase funding for information and communication technology to €11 billion, digital inclusion, etc. The above-mentioned measures should increase the availability of broadband internet in rural areas.

2. BROADBAND INTERNET ACCESS SERVICES

The boundary between narrowband and broadband communications, according to [1], is set to 2 Mbit/s (1.5 Mbit/s in the U.S.), i.e. to the higher speed than the primary ISDN access speed. However, that limit had later been shifted towards lower speeds, i.e. to 144 kbit/s data rate which is the basic ISDN access (U.S. 200 kbit/s).

With the progress of technology and telecommunications market, initially defined minimum broadband speed of 144 kbit/s in the EU is slowly losing its importance when it comes to practice, i.e. on the EU market in mid-2010, more than 87% of broadband connections run at speeds above 2 Mbit/s [2].

It should be emphasized that these terms of basic, fast and ultrafast broadband connections, although, according to [1], defined within the Croatian Strategy, and in numerous European Commission documents, have not been widely accepted and are often used for different ranges of mismatched access speeds (e.g. fast broadband connection is a connection with speed above 10 Mbit/s). In order to reduce ambiguities and for later referencing purposes in the study, according to [3], four types of broadband connections are defined, according to the access speed ranges (Table 1). Listed ranges of access speeds are related to the download speed, while the upload speed can be and usually is lower.

Table 1 - Types of broadband connections

Label	Ranges of data transfer access speed
U1	144 kbit/s – 2 Mbit/s
U2	2 – 30 Mbit/s
U3	30 – 100 Mbit/s
U4	> 100 Mbit/s

Source: [3]

2.1. INTERNET BROADBAND ACCESS TECHNOLOGIES

Existing technologies that offer the possibility of broadband Internet access can be, according to [1], depending on the transmission medium used and appropriate technology, classified into following categories: wireless access (optical signals, satellite feeds links, radio access - WiMAX, 3G, LTE), optical access (FTTx) and wired access (Digital Subscriber Line technologies (xDSL), cable, power cables and network access via leased lines.

Although DSL technologies dominate the market, telecom operators are increasingly oriented to wireless technology. Primary classification of wireless broadband technologies is based on speed and data transfer. Given the range of data transmission, networks can be divided into: WAN (Wideband Area Network), a long-range network; MAN (Metropolitan Area Network), a city-range network; LAN (Local Area Network), a local scope network and PAN (Personal Area Network), a short-range network.

Wireless broadband technologies represent an attractive solution for high speed access to Internet and to data, voice and video services. The major advantage of wireless to wired and optical technologies is a relatively low cost of implementation. However, wireless access network still can't, by its performance, compete with wired and optical networks [1]. The most important wireless broadband access technologies (described in a more detail below) are cellular access technologies (Table 2), wireless optical access and satellite links.

Table 2 - Data transfer speed of wireless (cell) access technologies

Wireless access technology	Data transfer speed	Feature
2.5G – GSM + GPRS/EDGE, CDMA 2000 1x	240 kbit/s	Broadband
3G – UMTS, CDMA2000 1x Ev-DO	384 kbit/s	Broadband
3.5 – HSDPA/HSUPA	14.4 Mbit/s	Broadband
Wi-Fi – IEEE 802.11	+50 Mbit/s	Broadband
WiMax – IEEE 802.16	+50 Mbit/s	Broadband
4G – LTE	+100 Mbit/s	Broadband

The greatest advantage of wireless optical signals (FSO - Free Space Optics) compared to the conventional technology of wireless data transmission, lies in the fact that it can achieve transmission speeds comparable with transmissions via fiber-optic cable, with substantial financial and time savings in implementation because there is no need for laying optical fiber cable. Conceptually, this technology is indistinguishable from the transmission through fiber [4].

According to [5], wherever there is an alternative solution, broadband Internet access via satellite connection is not suitable for connection. The satellite links are useful in areas with the lack of terrestrial infrastructure, where it is necessary to provide a link. However, as a result of great distance that signal must traverse, there was an obvious delay in communication in older satellite technology.

Certain wired access technologies use some of the wire mediums for data transmission, and provide the possibility of broadband Internet access. The development of broadband Internet access and data transfer speed, using one of the wired access technologies, is shown in Table 3. Basic classification of the given wired media is the copper pair, cable network (coaxial cable) and power line network access.

Table 3 - Wired broadband technologies

Wired access technology	Data transfer speed	Feature
Dial up	56 kbit/s	Narrowband
ISDN	144 kbit/s	Broadband
ADSL	8 Mbit/s	Broadband
Cable access	+10 Mbit/s	Broadband
ADSL 2+	24 Mbit/s	Broadband
Leased lines	<34 Mbit/s	Broadband
FTTC + VDSL2	100 Mbit/s	Broadband
FTTH	+1 Gbit/s	Broadband

In the case of broadband Internet access using optical fibers, Fiber to the x (FTTx) is used. According to [1], it includes: optical fiber to the apartment - Fiber to the Home (FTTH), optical fiber to the building - Fiber to the Building (FTTB), fiber to the curb - Fiber to the Curb (FTTC) or Fiber to the Kerb (FTTK) and optical fiber to the cabinet - Fiber to the cabinet (FTTCab).

2.2. THE USE OF BROADBAND SERVICES

The basic service, provided through broadband connections, is a high speed internet access, allowing users to adopt a wide range of applications: educational, business, and informative purposes. It should be pointed out that there is a whole range of electronic systems and applications that allow an access and use of Internet public services to citizens (e-education, e-health, e-government, e-business, e-commerce, e-banking, distribution of TV content, etc.). Some of the most important services for the broadband expansion are: information services, communications services, electronic mail, multimedia messaging, audio-visual services, etc.

As shown on Table 4, some of the services require a specific transfer speed for their continuous performance. Data transmission speed lesser than those shown on Table 4 lead to a reduction in the quality of service or to a hampered performance.

Table 4 - Information and communication services and data transfer speed requirements for data transfer, [7]

Service/activity	Minimum required data transfer speed
E-mail, Web search	64 kbit/s (narrowband)
Download (smaller files)	128 kbit/s
Music files download, loading video files	1.5 Mbit/s
Shopping/loading films, IPTV (standard quality)	5 Mbit/s
Blue-ray video	16 Mbit/s

The positive effects of the widespread broadband infrastructure deployment can be grouped within four main categories: education, health and welfare, employment and economic development, as well as energy and transport. By comparing the movement of broadband penetration in Croatia (the national average) and the EU (average of all Member States), in the period from end-2006 to the end-2011, the Croatian average is continuously lagging behind the EU average. This lag is being reduced, too. Also, after the 2009 there has been an expansion slowdown in broadband connections in both, the EU and Croatia. It is partly caused by the economic crisis. [8]

By analysing the status of broadband infrastructure at the village (smalltown) level, as well as basic demographic population unit, it was found that 2.2% of the Croatian population (or about 92,000 people) in mid-2012 was not covered by broadband infrastructure and did not have an access to broadband services. The areas without broadband infrastructure included a total of 1,025 villages, most with less than 200 residents, usually located in mountainous areas, areas affected by the homeland war, islands, and in rural areas.

At the same time, according to [9], some additional information and current broadband status in Croatia can be seen through “The broadband access availability areas” interactive map (Figure 1), depicting the three speed categories (2-30 Mbit/s, 30 - 100 Mbit/s, and over 100 Mbit/s), with the remark that the available speeds are displayed in a way that they can be achieved without any major investments or an extensive work on electronic communications networks.

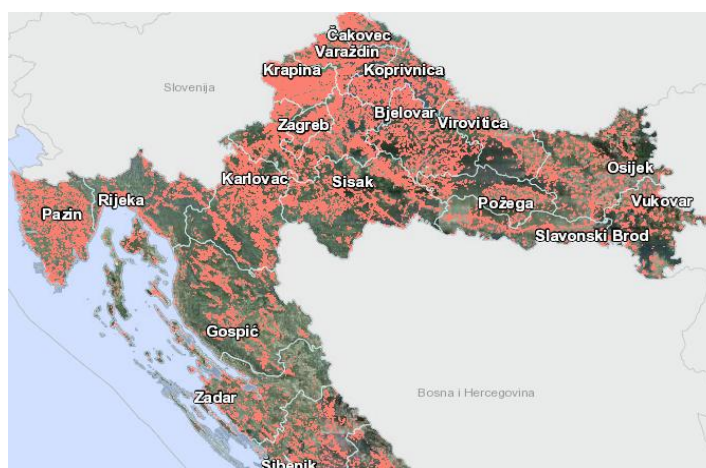


Figure 1: Interactive map „ The broadband access availability areas “, [9]

3. CHARACTERISTICS OF RURAL AREAS IN CROATIA

For administrative purposes, the difference between rural and urban areas in the Republic of Croatia is based on the territorial division, where the smaller administrative units, municipalities, are considered rural, while cities are considered urban areas. On this basis, according to [10], 44.4% (1,971,005) of the total population (4,437,460) is considered rural while 55.6% (2,466,455) is considered to be urban residents.

By applying the OECD criterion (150 inhabitants per km² in the local administrative units in the county), for the purpose of defining rural areas in Croatia, according to [10], Table 5 shows the percentage of rural and urban areas.

Table 5 - Rural and urban areas, population and smalltowns according to OECD criteria, [10]

CLASSIFICATION	OECD criterion					
	km ²	%	Number of small towns (villages)	%	Population	%
Rural areas	51,872	91.6	6,001	88.7	2,110,988	47.6
Urban areas	4,731	8.4	763	11.3	2,326,472	52.4
Total	56,603	100	6,751	100	4,437,460	100

Although reduced in the previous period, after government incentives, there still remains a significant uneven density of broadband Internet access via fixed networks in

Croatia, and thus the legitimacy of selective incentives in the development of broadband Internet access (Figure 2).

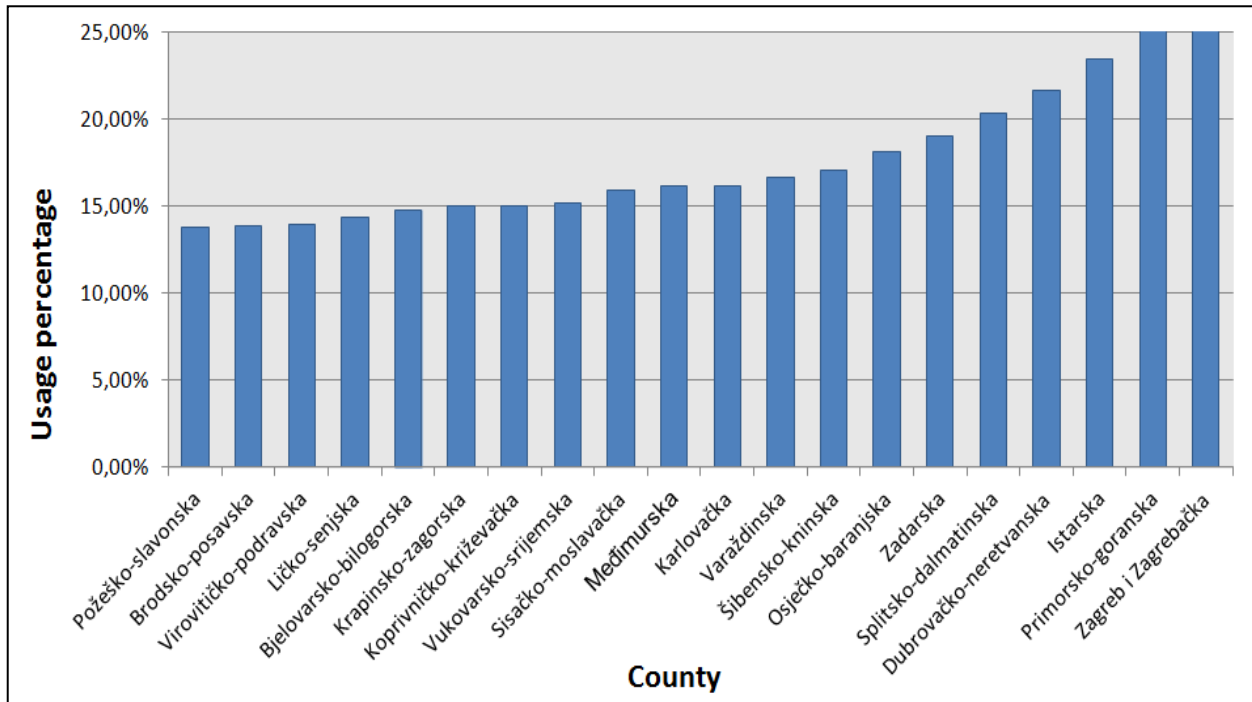


Figure 2 - The density of fixed broadband Internet access per county in Croatia, [11]

According to [12], there are several reasons for a lower broadband penetration rate in less attractive investment areas. The fact that the potential user density is lower and distances, at the same time, larger in rural areas, is resulting in more expensive implementation. The lower density leads to lower demand, i.e. lower revenue per user for operators.

Furthermore, the age structure of the population in rural areas is less favorable. Older people are less likely to use the Internet because they are not familiar with computers and are often afraid of technology or, more precisely, they are afraid of making mistakes. The rural population is often less educated, resulting in lower computer literacy. The problem is a potential barrier when using the Internet. Local communities often don't make enough effort to change the current situation.

4. THE OBJECTIVES AND GUIDELINES OF BROADBAND ACCESS EXPANSION

The determinants of the Digital Agenda for Europe are related to status of broadband expansion in Croatia up to 2011 and also to expected economic effects at the country level. In the area of broadband expansion in the EU, for the first time Digital Agenda for Europe outlines specific actions, objectives and recommended deadlines for achieving these goals. In this way, the greatest benefits for the economy and for the European Union population itself are gained.

The goals of Digital Agenda for Europe, according to [6], are:

1. Single digital market,
2. Digital inclusion – the increase in use of the Internet to 75% of the EU population by 2015,

3. Public services,
4. Broadband access availability (basic, fast and ultrafast access),
5. Research and development – increasing funds for information and communication technology up to €11 billion.

Investments in the broadband access development are certainly promising if approached in a responsible way, which is proven by the results of numerous studies. According to [13], the increase in the number of broadband users influences the growth of gross domestic product (GDP), and the more developed the country, the greater the influence. Forecasts predict a possible GDP growth of 0.47% in countries with less developed broadband internet access, of 0.63% in countries with fast-developing broadband access, of 0.70% in big industrial countries and 0.89% in the most developed countries, which are using all the possibilities offered by the knowledge society to their full extent.

According to [14], it is expected that investment into broadband access by 2015 will create about one million new jobs in European Union Member States and provide incentives for the economy amounting to €850 billion. Reference [15] mentions four indicators directly related to the creation of the broadband benefits: (1) average income, (2) number of computer users, (3) number of smartphone users, (4) network coverage.

On the basis of assessments of direct and indirect benefits from broadband expansion, the analyses show that, in the period between 2010 and 2019, Croatia could enjoy direct benefits amounting to between €2.2 and 3.2 billion. The studies also say that, generally speaking, a 10% increase in the number of broadband users leads to 1.38% GDP increase, which results with the increase in the number of jobs related to network development and maintenance, as well as to the increase of general economic activity resulting from increased usage of electronic services provided by broadband access [15].

According to [6], the main objective of this strategy is to create preconditions for further development of broadband Internet access, to ensure its availability to citizens and the business sector and to point out all the advantages offered by broadband use in different segments of society, such as education, health and public administration. It is crucial to enable services requiring high access speed, as a basis for further development of information society and knowledge-based society, and to ensure availability of broadband access services under equivalent conditions in the entire territory of the Republic of Croatia.

Specific objectives arising from the main objective of the strategy, according to [6], are:

1. Ensuring effective market competition,
2. Ensuring availability of broadband access,
3. Encouraging demand for broadband services and use of broadband access by citizens and business entities.

The objective of effective market competition is to develop open-type infrastructure together with an appropriate offer of broadband services that may be used by all participants on the electronic communications market.

By ensuring the availability of broadband Internet access with the target values shown in Table 6, it wants to achieve higher percentage of population who will have the option of broadband Internet access, regardless of area of residence.

Table 6 - The target values of broadband Internet access availability, [6]

Indicator / Target value	2013.	2015.
Availability of fixed broadband connections (share of the population to which the service is available)	75% (≥ 2Mbit/s)	35% (≥ 30Mbit/s)
The availability of broadband access (share of the population to which the service is available)	90% (≥ 2Mbit/s)	50% (≥ 30Mbit/s)

By stimulating demand for broadband services is a way to achieve the goal of increasing the number of users of broadband Internet access in the widest range of population, with the target values shown in Table 7.

Table 7 - The target values of broadband Internet users, [6]

Indicator / Target value	2013.	2015.
Total number of fixed connections	1,000,000 (≥ 2Mbit/s)	500,000 (≥ 30Mbit/s)
Total number of mobile connections	500,000 (≥ 2Mbit/s)	700,000 (≥ 2Mbit/s)
Broadband connections share from the total number	50%	75%

The main view of the development of broadband Internet access may be reduced to three dominant segment in this area: Information and communication infrastructure, the population of rural areas of Croatia, and state and local governing bodies.

Based on the stated objectives, basic guidelines and steps needed are visible of upgrade of the existing system. It's apparently that increase of the use of broadband Internet access entails a number of infrastructure changes. The development of broadband Internet access in rural areas is a prerequisite for the realization of the telecommunications network by using some of the existing technologies that enable broadband access to the Internet.

Furthermore, beside the infrastructure, a significant contribution to increase use of broadband Internet access is provided by the users and the population of rural areas of Croatia. The users' awareness of the possibilities and ways of using broadband service, its convenience and ease of use, greatly affect the development of the entire system.

As one of the key factors in the development of broadband Internet access in rural areas of Croatia, local and regional governments and their rural development policy are pointed out. It is desirable that precisely these factors that anticipate the need and application of broadband Internet access. Adequately informing the population, encouraging the use of information and communications equipment and services, business modernization and impact of the reduction in prices of telecommunications services in their area, represent only some of the tasks of local and regional authorities and governments.

5. CONCLUSION

In order to reduce the social, cultural and economic differences in various in Croatia, it is necessary to use all available measures and methods of homogenization for a country to develop. Decentralized management and equal development of all areas is a relevant authorities' field of interest. Although, the lifestyle of urban and rural parts of Croatia varies to a greater or lesser extent, it is necessary to apply the common principles and technologies

that will enable higher quality and standard of living of the population of these areas. One of the indicators of the differences between these areas is the level of broadband Internet access availability.

In mid-2012, 2.2% of the population (aprox. 92,000 people) didn't have broadband infrastructure and therefore were without an access to broadband services. Those areas (total of 1,025 villages/small towns with a population of <200 inhabitants) are generally mountainous areas, the areas devastated by the homeland war and the islands (rural areas).

According to the above-mentioned, it is evident that there is still a discrepancy in the development of particular regions, and therefore in some minor (urban and rural) areas, too. It is important to minimize these differences, thus broadband Internet access expansion seems reasonable, primarily in rural areas.

The purpose of increasing the availability of broadband Internet access in rural areas, primarily relates to the reduction of, so-called, digital divergence between developed (mainly urban) and rural (less developed) areas. As a result of the previously mentioned problems of rural areas (geographic dispersion, commercial unattractiveness, and population level), it's necessary to motivate the local government to invest in such areas. The Republic of Croatia should strive to reduce the centralized development of the country, regardless of the economic, cultural and tourism development. Considering the fact that the expansion of broadband Internet access is indirectly associated with economic development of the country, the coordinated development is of inevitable importance. Available broadband access resources are preconditions of the adequate development of information and communication technologies.

Consequently, it is necessary to align with the directives of the European Union and the Strategy for broadband development in the Republic of Croatia within the period from 2012 to 2015. These guidelines are crucial for the broadband expansion of an integrated, unified and systematic development of the country. This development should be based on modern information and communication society. Numerous factors (e.g. income and GDP increase) are directly affected by increased availability of broadband access, as shown in this paper.

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