Chapter 18

Economic Interests and Social Problems in Realization of Broadband Network

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Additional information is available at the end of the chapter

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Abstract

Investments in broadband access are very useful for local community, especially for the underdeveloped and developing countries. The emphasis is on importance of broadband infrastructure and the use of Internet in the world, the EU and the Republic of Croatia as one of its member state. Implementation analysis of the "Slavonian Network" project in Slavonia, (Croatia region) for the period 2012 to 2017, points to a number of problems that were recorded in development of the broadband and to technical, economic, legal, and social issues as well. The density of broadband connections and users in Croatia is significantly lower than the average of the EU, and in five counties in the Slavonia region, this average is in turn lower than in Croatia. This state of affairs prevents social and economic development, effective functioning of the public administration, and inclusion of the region in modern communication within the country and within EU. The construction of broadband infrastructure is a significant economic and technical activity for all countries, especially for the countries lagging behind in economic and technological development. This paper points to the model of regional approach to building broadband infrastructure that can be a good model for all developing countries.

Keywords: broadband, economic interests, infrastructure, local development, society

1. Broadband network

Scientific knowledge and new civilization's knowledge grow exponentially in time; at the beginning of the twenty-first century (2005–2010), thus, the amount of knowledge in scientific disciplines has doubled every 5 years and in some areas in less than 2 years. Expansion and accumulation of knowledge depend today on establishing communication network for fast and efficient data transmission [1, 2]. Broadband is a civilization tool that provides the fastest data transfer today. The chapter deals with broadband access conditions for existing networks in the

world, particularly in Europe, and economic issues related to the construction of broadband networks. The example of one Croatian region refers to social problems that are characteristic of the construction of infrastructure installations in the transition of underdeveloped countries.

1.1. Importance of broadband network

Development of fast access networks expresses the same revolutionary effect in society today as it has been during the development of railway or power grid 150 years ago. Modern information and telecommunication technology (ITT) has significantly altered the lifestyle of people over the last 20 years by accelerated data transfer, increase of their quality and reliability, by reduced operating costs, by accelerated business transactions and by providing fast access to the global market. New ITT is the foundation of knowledge economy. Instead of capital, information and knowledge have become the basis of individual and social growth and development. Digital content and applications are expected to be covered almost completely by Internet delivery after 2020 [3, 4]. Concepts and approaches to building smart cities have already been set up [5]. However, development of high-quality, fast, reliable, and inexpensive public services is important for the whole country as well. This is important for public sector state administration and local self-government, healthcare, education, as well as for business of the entire economy, and encouraging development of rural and underdeveloped areas in each country. Development and implementation of new ITT are particularly important for developing countries because increased coverage of ITT infrastructure that enables high-speed Internet reduces migration of rural population to cities or developed countries.

1.2. Categorizing the availability of broadband access

The accessibility to broadband is categorized on maps with three shadings:

a. **White areas** include areas where broadband access is not available, or where there is no adequate broadband infrastructure.

b. **Gray areas** are those where only one operator offers broadband services or multiple operators offer with insufficient level of competition, resulting in an inadequate supply of broadband services for end users in terms of quality and price of services.

c. **Black areas** are those where at least two operators offer broadband services with a satisfactory level of competition, i.e., the quality and price of services for users.

This categorization of broadband services is carried out in two levels:

a. Basic or traditional broadband access based on copper wires that allow data transmission up to 10 Mbit/s, or with some additional procedures up to 30 Mbit/s.

b. NGA (broadband access network of new generations) based on fibers that enable speeds faster than 30 Mbit/s.

1.3. Developmental effects of broadband access

Developmental effects of broadband infrastructure are socially positive and can be classified into four main sectors: (a) education, (b) health and social care, (c) employment and economic development, and (d) energy and transport—as is already discussed in Refs. [6–10].

1.4. Development models of broadband infrastructure in EU

Building a fiber optic network is infrastructure project that cannot be funded only as a private venture investment. EU has set out Digital Agenda [4] as a strategic document for equal access to broadband Internet for entire EU population. The viability of such investments does not motivate operators or private companies to invest in sparsely populated or rural areas. For these reasons, a number of EU funds have been offered and state aid grants approved for the construction of broadband infrastructure, all under special conditions in order not to undermine the rules of free market competition.

The development of broadband infrastructure in EU countries has been intensive for a decade and several models have been developed: (a) business, (b) markets, and (c) investment, determined by: (1) competitive services, (2) authorities and operators (private companies), (3) investment shares and responsibilities for infrastructure design and management, and (4) acquisition and retention of ownership over the built infrastructure. This complex issue of building broadband infrastructure further aggravates the number of models of possible use of telecommunication technologies, as each of them has its advantages and disadvantages. It is therefore important to get acquainted with all the essential elements in the process of broadband access planning.

1.5. Financial sources for broadband infrastructure construction

Construction of broadband infrastructure in large cities and urban agglomerations ensures quick return of investment in several years so that telecommunication companies (private entrepreneurship) fund this construction and will continue to finance it—according to market criteria [11, 12]. For other areas—smaller cities and rural areas—models of stimulated broadband infrastructure construction have been developed and their sources can be divided into three basic groups:

a. **Public funds**—include all budget funds at the national, regional, and county levels and local level (cities and municipalities), as well as all funds invested by publicly owned companies. Funds from the EU Structural Funds-the European Regional Development Fund, the European Social Fund, and the EU Cohesion Fund-are also considered as public funds. From EU funds, it is possible to cofinance infrastructure projects up to 85%, while other funds are secured from national budget sources.

b. **Private funds**—include funds from private operators in the electronic communication market and, eventually, end user funds that may be involved in cofinancing the implementation of broadband infrastructure, commonly the end-segments of the access network.

c. **The funds of institutional investors**—institutional investors are considered as banks and investment funds, including pension funds. Since their primary interest is the realization of economic gains, institutional investors appear to be the investors of broadband infrastructure projects only in the most densely populated areas (mostly black areas) where they become sustainable business models.

State subsidies are justified in white and mostly in gray areas, while in black areas, they are not justified. The share of grants in project financing is rising to less populated areas (generally white areas) and can reach (in special cases) up to 100%. In contrast, the share of private fund operators

increased to more densely populated areas (gray and black areas), while decreasing the share of public funds in the financing of projects. Public funds can be invested in black areas only under market conditions together with the funds of private operators and institutional investors [12, 13].

2. Investment in broadband network infrastructure

Broadband network investments are complex, because of fast-growing broadband technology, the issues of monopoly and network exploitation, and different uses of broadband and spectrum of users. It is important for each investment project to study a variety of details ranging from area mapping choice of investment model construction costs to the cost of exploitation in order to determine the term of the investment return.

2.1. Mapping areas

Mapping area is a spatial view of the area with data on availability status of basic and NGA broadband access of all operators. The purpose of mapping is to determine areas where it is justified to carry out individual projects based on the rules and guidelines of the Framework National Program (FNP). The shading of area is determined as follows [12–16]:

- White areas: areas where there is no adequate broadband infrastructure and no operator plans to build broadband infrastructure in the next 3 years,
- Gray areas: areas where there is an operator's broadband network and no other operator plans to build an additional network in the next 3 years,
- Black areas: areas where there are at least two broadband networks belonging to two different operators, or according to expressed interest of operator, there are at least two networks planned to be built in the next 3 years.

2.2. Cost of broadband network building

The cost of building a broadband network depends on the above density of access, and here are three zones: (a) black = highest density, large urban agglomeration, (b) gray = smaller density, smaller cities, and (c) white = poorly populated area, villages. According to this criterion, fixed cost per single connection is also shared.

In the example of the UK and similarly in other EU countries, 67% of the connections have lowest cost of building broadband connection in each regional area. It is twice as expensive to build a connection in gray zone amounting to next 23% of connections, and cost of building a connection in white zone is three times higher than in first zone, **Figure 1**. For this reason, the European Commission (EC) cofinances investments in white and gray zone according to certain criteria [12, 15–18].

The share of land works in costs of communal infrastructure construction such as plumbing, sewage, public lighting, water supply, and public infrastructure such as electric underground

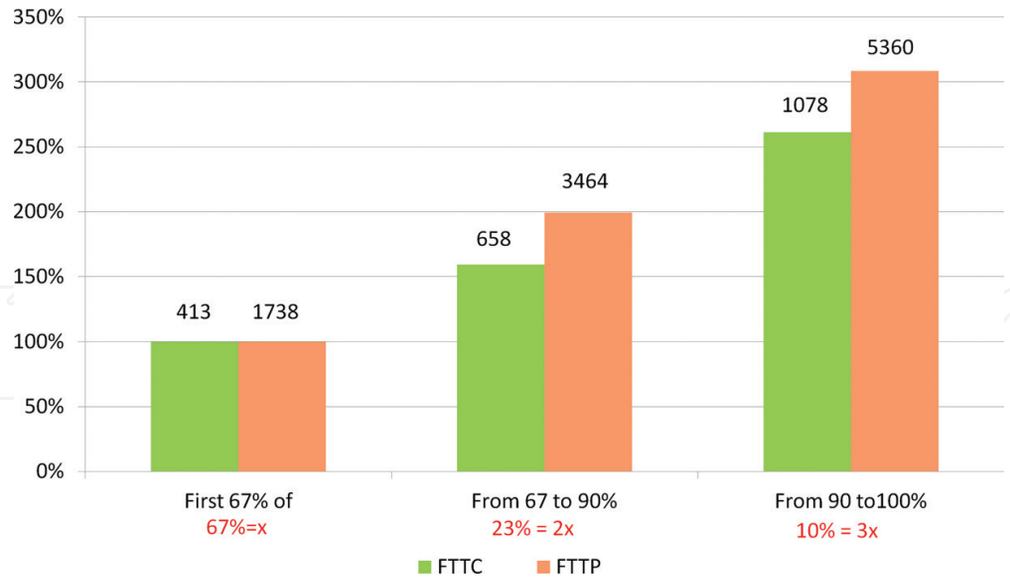

Figure 1. Deployment cost per premises connected (£) [17].

network and gas pipeline in Croatia ranges from 20 to 60% of total investment depending on the type of terrain. The share of land works in the construction of fiber optic infrastructure (FOI) is about 70%. This fact suggests that integrated approach can achieve a significant reduction in investment costs in telecommunication infrastructure construction. More on this is given in Ref. [14–21]. For this reason, EC has adopted Directive 2014/61/EU on measures to reduce the cost of setting up high-speed electronic communication networks [22] and requests from Member States to jointly use FOI and other types of electricity, gas, pipeline, water, drainage, and hydroelectric infrastructure, commonly referred in the Directive as "physical infrastructure."

2.3. Operating costs and return on investment

Costs of exploitation and profit making in broadband networks that is realized as return on investment depend on several criteria: number and density of connections and type and scope of service use. Thus there exist different exploitation models in economic and technology segment. The return on investment in large urban agglomerations with high density of connectors and large consumption of different services is 2–4 years. The return on investment in smaller cities with lower density and volume of spending is about 8 years, while in poorly populated areas, this amounts to 20 years [18].

2.4. Investing models in broadband access

Broadband infrastructure implementation projects can be carried out using several investment models that are defined by the relationship between public authorities and operators as private entrepreneurs in the project. These relationships include investment shares, responsibility for network building, management, and acquisition and retention of ownership over the built infrastructure [17, 18, 22]. The following investment models are most frequently used in practice:

- **Bottom up** model (local community model) involves a group of end users in the local community that are jointly owned and a democratically controlled group capable of overseeing a local network construction contract. The public sector here is limited to granting aid—as a guarantor of loans and/or facilitating access to the public property of infrastructure such as FOI.
- **Public DBO** model encompasses all cases in which the implementation of broadband infrastructure construction is performed under supervision of public authorities without any private sector assistance and where the ownership of built infrastructure remains permanently in public ownership. Public DBO model requires significant engagement of administrative and technical capacities of local government bodies, but it allows for long-term preservation of public interest. A public-sector operating company can operate on the entire network or it can only provide wholesale services and allow private operators to sell retail services.
- **Private DBO** model includes cases where private operators are beneficiaries of granted grant right to build and manage infrastructure with permanent retention of ownership over the built infrastructure. This model does not require significant involvement of public authorities in project implementation. In this context, the protection of public interest is limited as the infrastructure built with incentives remains the property of private operator.
- **Joint Venture** model is contract based whereby ownership of the network is shared between public and private sectors. Construction and operational functions are likely to be undertaken by the private sector. The model implies a joint investment venture of local authorities and private operators possibly with financial hunt of institutional investors. It is possible in this way to balance public interest by coverage of broadband infrastructure and interests of private investors who can achieve economic gain.
- **Public model** of external service; this model is similar to private DBO model, with a difference that infrastructure built up by public incentives remains in public ownership after expiration of external service contract. Under this model, one contract is awarded for all aspects of construction and operation in network. The main feature of this model is that the network is set up by private sector, but public sector retains ownership.

2.5. Investment models in Croatia

The construction and expansion of broadband network are complex processes and it is necessary to point to the specificity of investment in this sector as this infrastructure by its nature cannot be a monopoly of private entrepreneurs. Thus, three investment models were defined in Croatia, defined by the ratio of investment stakeholders, public bodies, and private companies. Models define the responsibility for building and managing the network and the acquisition and retention of ownership of the built infrastructure [15, 16, 19, 23].

- Model "A": private DBO model; in this model, responsibility for design, construction, and operation of the network is left to private operator, and built-up network remains owned by that operator. The design of network means here the process of making detailed technical specifications of network construction project according to relevant regulations and based on general specifications is made by the local community project manager (PM).

- Model "B": public DBO model in which responsibility for design and construction and network management lies on local government bodies and the built-up network remains in permanent public ownership. Local authorities, as project manager (PM), are fully responsible for implementing the project on model "B." In some activities, PM may engage specialized private companies due to lack of administrative capacity and/or expertise in public authorities. Also, in the case of network maintenance and management in Model "B," private companies can be engaged, whereby it is essential that, in the management, private companies do not get right to collect fees from end users of the network because such access would have characteristics of concession.
- Model "C": public-private partnership (PPP); this investment model combines models "A" and "B." In the context of broadband infrastructure construction projects, private partner in PPP model can take responsibility for design, construction, management, and maintenance of the network and also partly cofinances network building by remaining part of network financing that provides a public partner through state aid. The constructed network returns to the public property after the expiry of duration of PPP contract, but not later than 40 years.

3. Development of broadband network

3.1. Contemporary broadband access in the world

Over the past 20 years, technological advances have been particularly perceived in the development of computing and telecommunications; a whole range of new devices and product services have been developed, developed and built infrastructure, service and product cost are reduced, a large part of population has mastered the use of information technology, and billions of people around the world are interconnected and communicating; the world is moving faster toward the information society. Industrial and information developed countries are at forefront in these processes; **Figures 2** and **3** and **Table 1** illustrate the above.

3.2. European development framework

The Europe 2020 Strategy brings vision of the European social market economy for the twenty-first century and proposes three complementary priorities: (1) smart growth: developing a knowledge-based and innovation-based economy; (2) sustainable growth: promoting a more efficient use of economies that are "greener" and more competitive; and (3) inclusive growth: maintaining an economy with a high employment rate that brings social and territorial connectivity [27]. The Digital Agenda for Europe has adopted concrete measures and targets and recommended deadlines for meeting these goals in the area of broadband access at European Union level in order to achieve the greatest benefits from such development for the economy and the EU population. The Digital Agendas for Europe's pillars are: (1) a single digital market; (2) improving interoperability and standards; (3) strengthening confidence in online and security; (4) promoting fast and ultrafast internet access for all: (a) basic access coverage: 100% of EU population by 2013, (b) fast access (30 Mbit/s or more) coverage: 100%

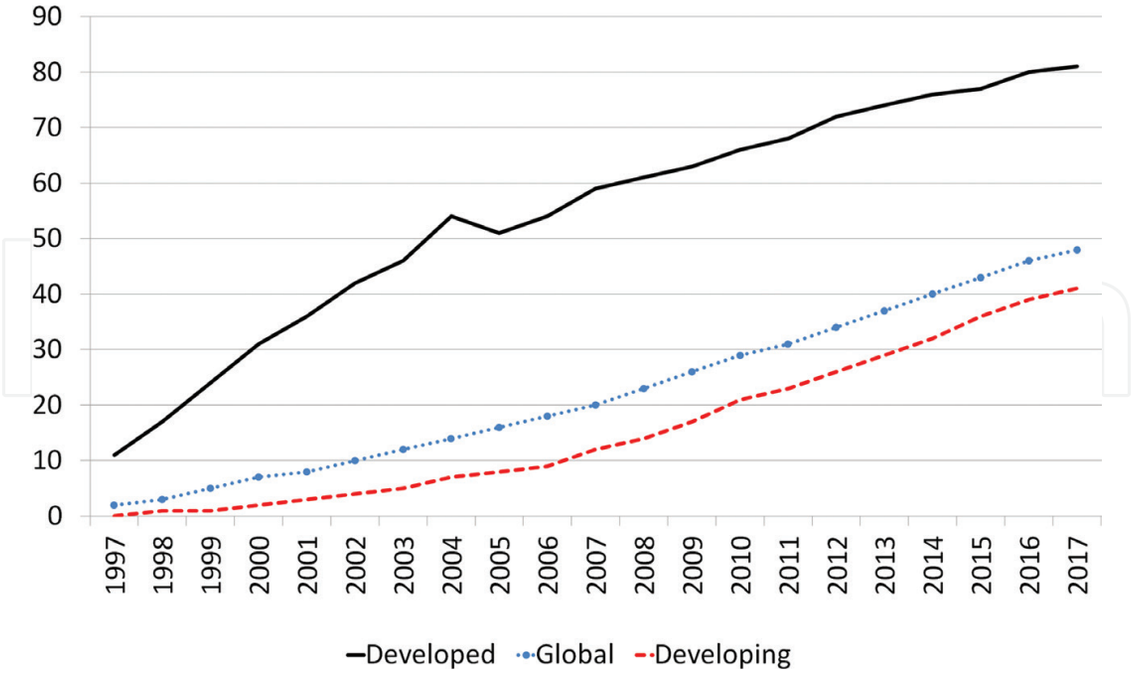

Figure 2. Internet users per 100 inhabitants [24].

of EU population by 2020, (c) ultrafast access (100 Mbit/s or more) use: 50% of EU households by 2020; (5) investments in research and development; (6) promoting digital literacy, skills, and digital inclusion; and (7) benefits for European society that enables ICT.

Investments in the development of broadband access are very useful for the community as stated in a series of studies prepared for the European Commission (EC). The increase of the number of broadband access users has an impact on GDP growth, and the impact is more significant as the country is more developed. Estimates of possible GDP growth are 0.47% in countries with less developed broadband, 0.63% in countries with faster growth of broadband, 0.7% in large industrial countries, and 0.89% in the most developed countries—which fully utilize all possibilities of the knowledge society. EC study [8] further explores the above assumptions

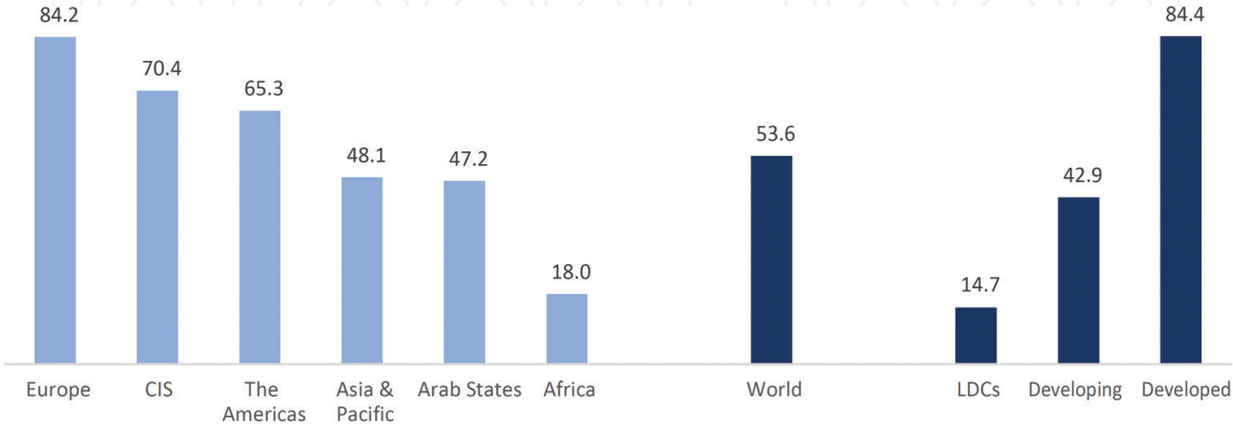

Figure 3. Broadband household penetration by region, 2016 (ITU estimates, %) [24].

World regions	Population		Internet users 30 June 2017	Penetration rate % population
	2017 (estim.)	% World		
Africa	1247	16.6	388	31.2
Asia	4148	55.2	1938	46.7
Europe	823	10.9	660	80.2
Latin America/Caribbean	648	8.6	404	62.4
Middle East	250	3.3	147	58.7
North America	363	4.8	320	88.1
Australia/Oceania	41	0.5	28	69.6
World (total)	7519	100	3886	51.7

Source: [25, 26].

Table 1. World internet usage and population statistics—June 30, 2017.

and directly relates four indicators to the benefits of broadband access: average income, number of computer users, number of smart phone users, and network coverage. Based on the estimates of the direct and indirect benefits of the development of broadband access to the analysis, EU could have direct benefits worth between 2.2 and 3.2 bil. € in the period from 2010 to 2019. It also states that in general terms a 10% increase in the number of users of broadband enables increase of GDP growth by 1.38%, which is reflected in the increase in the number of jobs in network development and maintenance activities and the growth of economic activity due to increased use of electronic services available through broadband access [28, 29].

EU Member States, alongside the efforts of the EC to promote broadband access development, independently adopt national plans and strategies for broadband access development. National plans differ from member states, whereby the following common trends can be noticed: plans relate to 3–5 years for a basic broadband approach and 7 years for fast and ultrafast broadband access. Goals are set to cover a certain percentage of households, i.e., households with broadband access at a certain minimum speed. Funds are provided to achieve the set goals. **Figures 4–7** show dynamics of broadband development in EU.

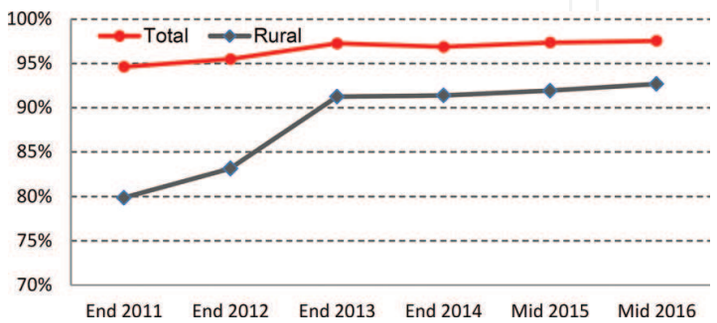

Figure 4. Fixed broadband coverage in EU, 2001–2016 [29].

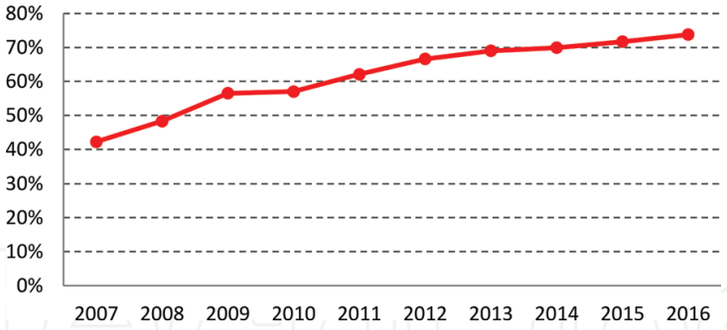

Figure 5. Household with a fixed broadband subscription in EU, 2007–2016 [30].

3.3. Development frameworks in Croatia

The Government of the Republic of Croatia adopted the 2011 Strategy for Development of Broadband Access in Croatia 2012–2015 [32] and Strategy for the period 2016–2020 [33]. Planning and construction of broadband networks NGA is financially very demanding depending on geographical characteristics and geo-demographic state. According to characteristics of settlements, Croatia (4.3 mil. inhabitants) is predominantly rural with an average population density of 75.7 inhabitants per km^2; a third of population is concentrated in 10 largest cities. Majority of Croatia possesses a spatially dispersed population, with a large number of smaller settlements; approximately one third of population lives in 211 settlements between 2000 and 30,000 inhabitants, while the last third of population lives in remaining 6384 settlements with less than 2000 inhabitants.

Croatia possess a 23.02% coverage in fixed public communications network, while EU's average is 31.6%. Broadband access map (2 Mbit/s) in Croatia (**Figure 9**) at city/municipality level shows large digital gap between urban and rural areas. Average availability of LTE technology in the EU Member States was 85.9% (from 100% in Norway and the Netherlands to 48.1% in Bulgaria) in June 2015. The availability of LTE technology in Croatia is 68.9% by June 2015. The progress made in implementing the NGA broadband infrastructure is unsatisfactory. According to Eurostat in June 2015, Croatia was at the mercy of EU members. Infrastructure availability in Croatia was 52%, and in the EU, 70.9% [30].

Construction costs of NGA networks throughout Croatia are about 1.65 bil €. The state of broadband access is shown in **Figures 8–10**. Croatia has shown a slow growth in density of

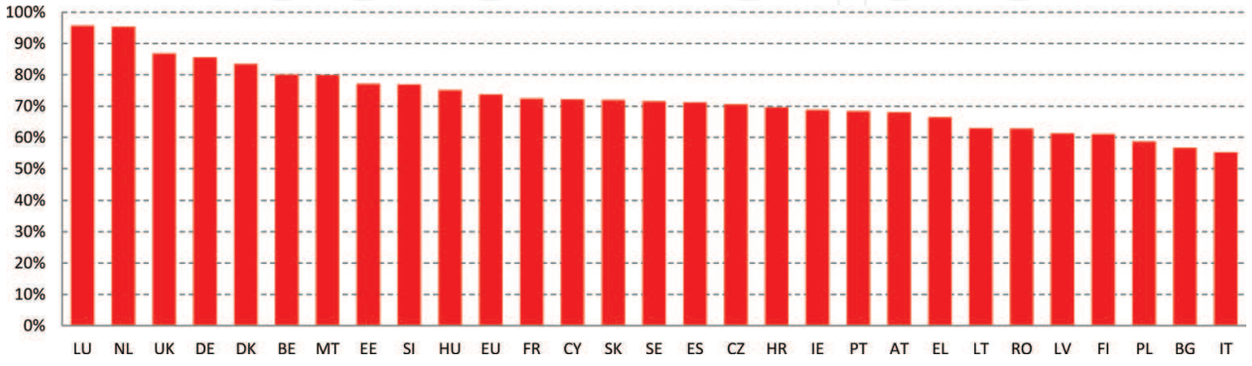

Figure 6. Household with a fixed broadband subscription in EU by countries, 2016 [30].

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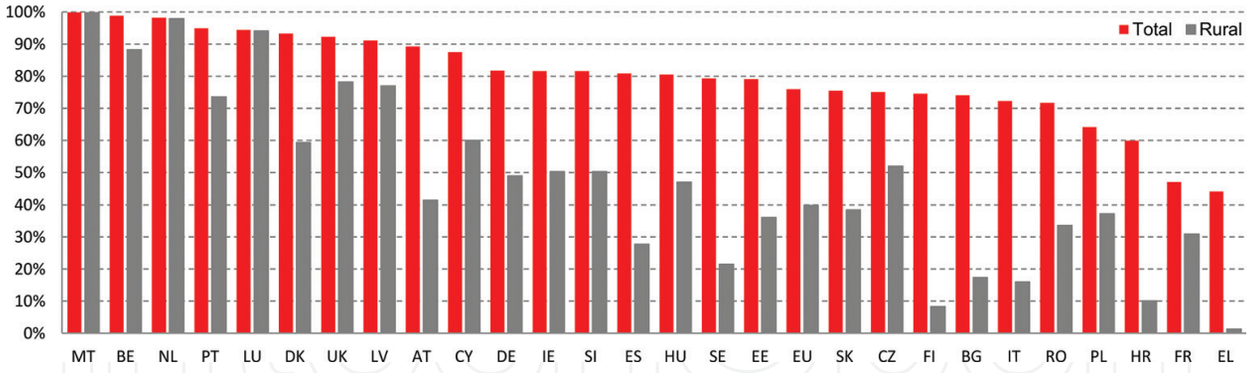

Figure 7. Broadband Internet access in EU countries—fixed network NGA (FTTP, VDSL, etc.,) [31].

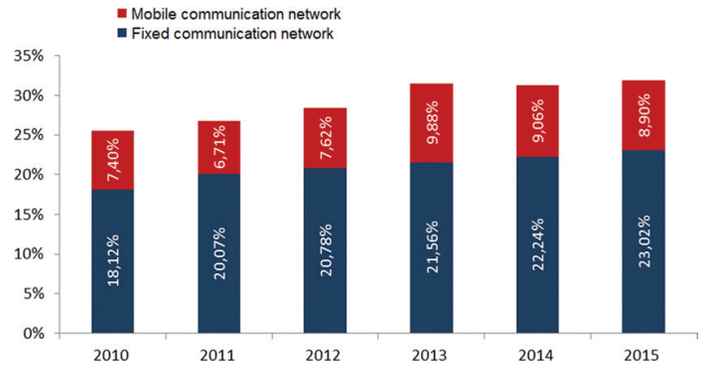

Figure 8. Density of broadband access in Croatia [33].

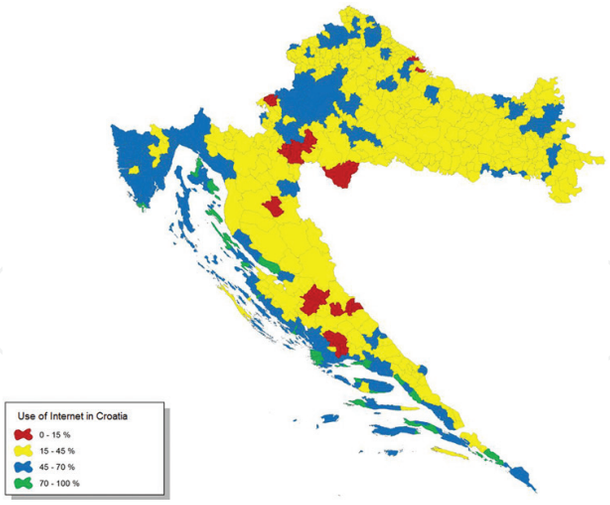

Figure 9. Map of Internet use in Croatia (speeds greater than 2 mbps) [33].

broadband connections from 2010 to 2015, **Figure 8**, but this is still insufficient, as Croatia lags behind average of EU, especially in fiber optic access networks.

The Slavonia region, which makes for quarter of Croatia, has been lagging behind the state average for the last 30 years. The reason for this was the 1991–1995 war destruction, mostly agrarian

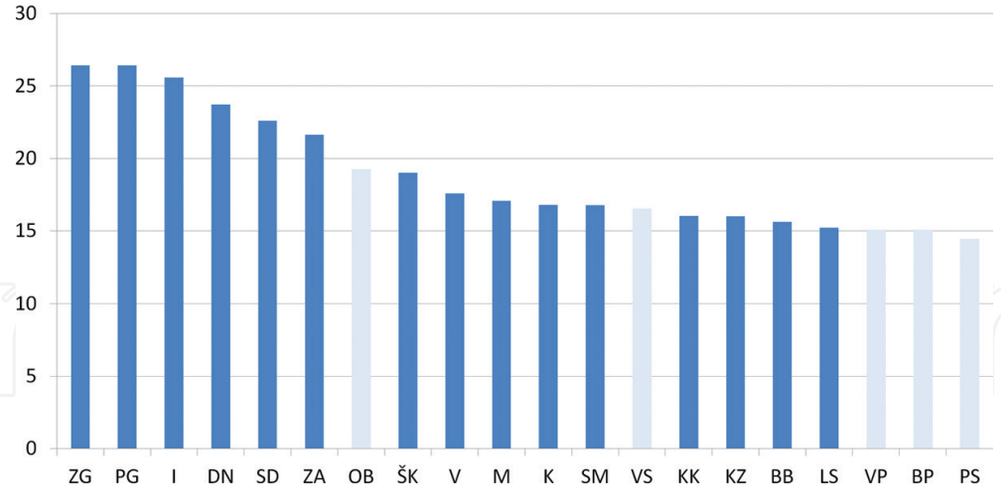

Figure 10. Densities of broadband access by Croatia counties—fixed network, 2011 [32].

production, and weak central government policy. The unemployment rate in Slavonia with once-developed industrial centers in the region is twice as high as the average of Croatia, so that significant inhabitant's migration to other Croatian regions or to countries of Western Europe has started in recent years. That is why, it was significant to launch the project "Slavonian Network." According to the density of broadband connections from the five Slavonian counties, three were at the end of the list (Požega, Virovitica, and Brod), one county (Vukovar) in the middle, and one (Osijek) in the first third of the county list in Croatia (gray columns).

4. The "Slavonian network" project

After adoption of the Broadband Access Development Strategy for Croatia from 2012 to 2015 (October 2011), in February 2012, Faculty of Electrical Engineering Osijek (FEE), in cooperation with Croatian Regulatory Agency for Networking, organized the conference "Development telecommunication infrastructure - strengthening competitiveness and efficient investment of local self-government," and it was attended by leaders of many municipalities, cities, and five Slavonian counties. At the end of that year, FEE initiated project "Broadband Access Development" with several engineer employees.

4.1. Launching the project

At the initial stage of the project, FEE colleagues called new researchers to team and create an interdisciplinary expert team (IET) consisting of PhDs, masters, and graduates of ICT, geodesy, economics, sociology, and law—from FEE and private companies "Geoprem" Ltd. Osijek (geodesy jobs), "Sokol" Ltd. Vinkovci (telecom_infrastructure construction company), and Panon—think tank for strategic studies Osijek. At that time, a new project concept was developed that covered the entire region (five counties of Slavonia), and the project was named "Slavonian Network."

The research team has set more provisions on future project activities that—apart from research on the state of telecommunication network and potential for future broadband use—need to launch a series of activities that the project needs to do interdisciplinary. The first provision

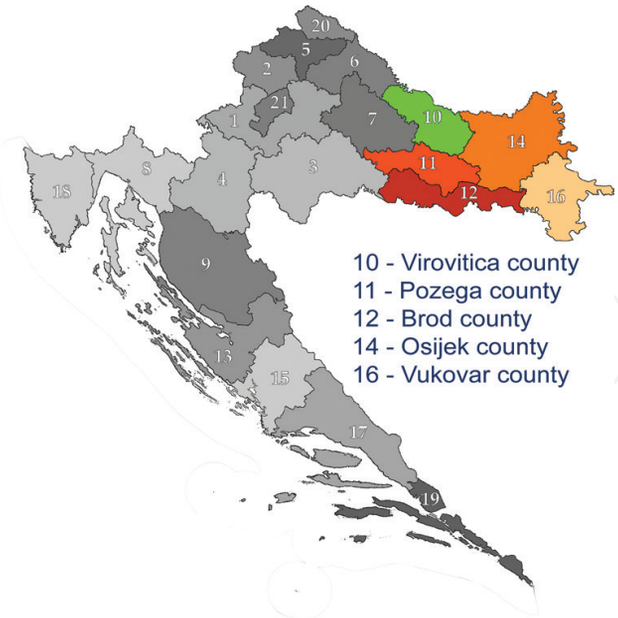

Figure 11. Five counties of eastern Croatia—Slavonia region [34].

(decision) of IET was (1) that the project will be structured modularly and (2) that results of research by individual modules will be published at scientific and professional conferences—in order to test hypotheses and at the same time promote the project, informing and mobilizing experts and local public about launching broadband in the region by gathering new experts and creating new teams for project work. Second important decision is that the IET will accept and follow the overall processing and rules of European funds to support broadband construction. Basic elements of this project were set up after introductory research, starting from goals of the National Broadband Strategy and local opportunities as:

- **Project implementation area**: five counties in Slavonia with 22 cities, 105 municipalities, and 998 settlements with more than 800 thousand inhabitants (**Figure 11**).
- **Project goal**: enable broadband and Internet access for 75% of population in five Slavonian counties by 2015.
- **The final beneficiaries of the project results are**:

1. Population in the five counties of the region,
2. State and public services in five counties of the region (health, education, social welfare, and public administration), and
3. Economy in the area of five counties of the region.

- **Evaluation of economic benefit** from the realization of the project:

a. More efficient functioning of public administration,

b. Better business results of economic entities,

c. Better and higher standard of living of the population, and

d. Development of new business-based broadband activities.

Ultimately, project realization can only contribute to GDP growth of 0.7% in the region—starting with project implementation.

- **Project tasks**:

a. Information and mobilization of local units for:

1. Determining of the telecommunication state,

2. Arranging cadastre of the electronic communication infrastructure (ECI) lines,

3. Arranging spatial plans for ECI,

4. Making a decision on collection of rentals for the use of existing ECIs,

5. Arranging relationships with ECI users,

6. Unifying funds from the road right to ECI,

7. Constructing and developing broadband,

8. Study of the state of local telecom infrastructure,

9. Developing a broadband funding study.

b. Establishment of a consortium for activities coordination of local units,

c. Professional assistance to local units—cities and municipalities—in technical, legal, and economic areas,

d. Expert assistance to local units in the design of bidding projects,

e. Regional project application for funds in Croatia and EU,

f. Launch of the macroproject "Development of Broadband Services in the Slavonia Region."

In the new concept of the project, it is emphasized that it is about:

a. Important issue of Croatia's technological connection to European communication flows,

b. Complex technological process for the development of broadband services,

c. Significant investment engagement,;

d. Demanding task of determining the status in local units, and

e. Important elements of spatial plans of local units.

Following internal discussions, IET concluding that it would be wrong to focus the whole project only on (a) activities of broadband construction, the team decided to start simultaneously with a wide spectrum of development activities. These activities should be initiated: (b) for future distribution of network maintenance and development of local broadband services, (c) for education of institutions, companies, and inhabitants for the use of broadband services; and (d) to motivate and direct students FEE to create applications for broadband services. In order to realize the

project, it is necessary to unite all social, professional, and financial potentials in the region. With regard to the efficient implementation of the project, establishment of the "Slavonian Network" consortium was suggested, which would harmonize procedures and coordinate implementation of key stages of the project. Members of the consortium would be representatives of five Slavonian counties, Faculty of Electrical Engineering, Osijek, Panon think tank, Osijek, and telecomm operators, which express a business interest in this field. In addition to team interdisciplinary work, two basic stages of launching broadband in the region are structured, **Figures 12** and **13**.

4.2. Project development

In March 2013, IET created the study "Slavonian Network: Broadband Network Development in the Five Counties of the Slavonia Region" [34], which was submitted to the Ministry of Regional Development; between 500 projects received, "Slavonian network" has entered a shortlist of 50 projects and ranked 11th. Project "Slavonian network" was the only project

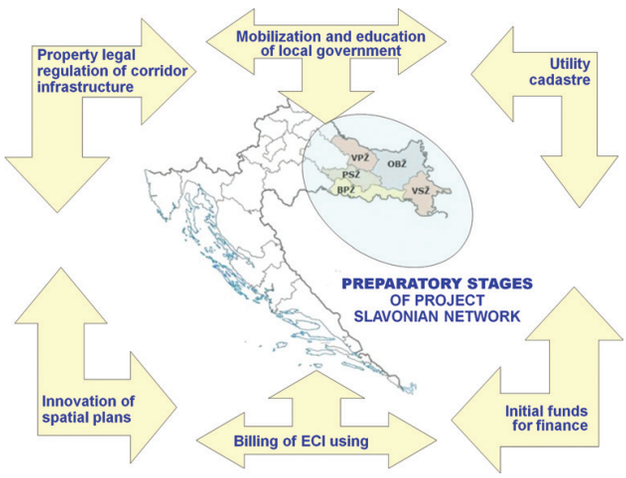

Figure 12. Structure of preparatory phases of "Slavonian network" project [35].

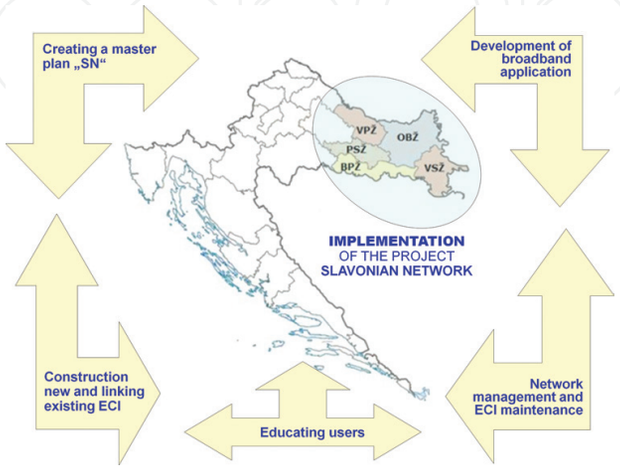

Figure 13. Structure of the implementation phases of "Slavonian network" project [35].

that united activities of more than one county and was the first project in the area of broadband access; this study involved five pilot projects of construction of broadband access in five Slavonian counties with a total value of 21.5 mil. €.

During the first half of 2014, project modules of the project were reviewed by expert teams of Ministry of Regional Development; in all three phase, reports of experts for assessment of preparation of the project received positive ratings. The project is foreseen to start immediately in implementation of the preparatory stages of "Slavonian network" (**Figure 12**), and when they are finished preparatory stages and provide financial resources for the implementation will be started second stages of the project (**Figure 13**).

4.3. Project implementation

Unfortunately, after the project got all the positive criticisms, FEE left that project and the project was taken over by the University of Osijek. The University has set up a new team of researchers who did not have broadband network references, and at the same time excluded all IET members and researchers who made the project concept, wrote, and developed this project from the project work. New team and project management did not realize the project as is accepted, but already started toward realization of the project according to its ideas. So they lost the next 4 years in an attempt to set up the company "Slavonian network" Ltd. who would carry out the project [36]. This company was registered only in late 2016. The founders of this company were University of Osijek and five counties of Slavonia. The Company was established as the executive pole for the implementation of the project "Slavonian network" in the area of five Slavonian counties.

In coming years—2014 and 2015 and 2016—new project management has periodically sought to choose a project management model and coordination of activities in municipalities, cities, and counties, i.e., IET proposal on founding of consortium has not been realized. During these years, new project team performed sporadically and partially the activities of the proposed modules of the "Slavonian network" (2013) project [19]. In this way, structured in the modules, the project "Slavonian network" which was highly ranked on the list of the Ministry of Regional Development and EU Funds and which received positive reviews, stopped halfway. Nearly 4 years have been lost in which all preparatory stages of the project and a large part of implementation stages could have been realized. Members of the new team did not make any new analysis for all 4 years, nor did they publish any professional or scientific paper on the broadband. Although the new project management and the established company "Slavonian network" Ltd. has taken over all the activities for the implementation of the project, "Slavonian network" IET has continued informal work—considering strategic issues of project—elaborated the project modules "Slavonian network" and published over 30 professional and scientific papers on domestic and international conferences and journals about this [37].

4.4. Analysis of results

During (informal) monitoring of preparation activities of Slavonian local units for development of broadband access, IET has noted:

a. A number of local units did not regulate fees from the right to service (renting), i.e., those municipalities and cities that regulated funds received from rent used the funds for other purposes instead of financing necessary business on developing broadband network.

b. In past years, more than 90 municipal projects on infrastructure in the Slavonia region were detected; with realization of integrated construction principle, significant savings that would have a positive (financial and temporal) impact on realization of broadband access can be achieved; namely, building or reconstructing on hundreds of kilometers of physical infrastructure (plumbing, sewage, gas, and public lighting)—that opportunity was not used for laying plastic pipes to which fiber optics could be later drawn—which would reduce construction costs by up to 70%. This recommendation was issued by the IET at the beginning of 2013, and there is also a commitment under the EC Directive on Integrated Construction (2014).

c. Leaders and expert services of local units are not educated about importance of broadband access, development potential of this project, and complexity and structure of these investments.

d. In Croatia, local units have started to develop Broadband Infrastructure Development Programs (BIDP) since 2015; local units from Slavonia were delayed in this activity; only a few BIDPs were created in mid-2017.

This statement is true of BIDPs in Slavonia, and the actual case analysis was published in the paper [23]. Insufficiently informed and unprepared local units in Slavonia started the development of local plans for BIDPs only at the end of 2016 and in early 2017. Only six BIDPs are prepared. **Tables 2** and **3** show the state of BIDP in local units in the region of Slavonia; only 40 cities and municipalities (out of 127) have prepared broadband network development programs within 6 BDIPs, and 5 of them have selected investment model "A," **Tables 2** and **3**.

The basic findings are:

- In case of five BIDPs, the investment model "A" (private DBO model) was chosen whereby responsibility for design, construction, and operation of network is left to private operator, whereby network is owned by that operator. This means that local units who receive EU grant for broadband construction lend their investment rights to investors or to private operators and at the same time they miss a number of development opportunities for their local community: such as rental income from broadband infrastructure built-up, network management, and development of their own local communications and establishment of a local network maintenance service, all of which can raise local potentials, among others, employment of local experts as the best means to reduce emigration of young people abroad.
- After review of all these BIDPs, it can be concluded that in these documents, there are no essential elements from original projects of IET (**Figures 12** and **13**) which was submitted to Ministry of Regional Development (2013).

BIDP	№ local units	% local units	% settlements	% inhabitants	% households
Yes	40	31.5	27.2	24.8	24.6
No	87	68.5	72.8	75.2	75.4
Slavonia	127	100	100	100	100

Table 2. State of BIDPs in Slavonia region—October 2017.

Invest_model	№ local units	% local units	% inhabitants	% households
A	39	30.7	24.1	24.1
B	1	0.8	0.7	0.7
C	0	0	0	0

Source: https://nop.hakom.hr./

Table 3. Proposed investment models in Slavonia region—October 2017.

Thus BIDPs didn't elaborate on:

1. Management of (future local) fiber optic network and its maintenance;
2. Integrated construction (in the construction of other physical infrastructure), which can reduce construction costs by as much as 70%;
3. Billing issues (rent) and directing these funds to the broadband development fund;
4. Mobilization of local expert and wider public regarding broadband access;
5. Education of (future) users and their preparation for the use of broadband services;
6. Organization of service distribution;
7. Development of new applications and sensors;
8. Regional control of broadband functioning in accordance with rules on consumer protection; and
9. Developmental effects of broadband access implementation at local level.

The untreated mentioned elements (from 1 to 9) in BIDPs indicate that whole process of broadband access will be based on unprepared users, which will result in a long period of time from construction of the broadband network to its full use. Likewise, opportunities for development will not be used, i.e., not will be to take advantage of local human, material, and financial potentials from broadband construction and that series of procedures will be left to the mercy (and misery) of market approach that brings profitable benefits only to telecom service providers and more lost benefits to the unprepared local community as it has been so far.

5. Business issues of broadband development

Failure and unsatisfactory result of a well-conceived, elaborated, and reported project to the Ministry of Regional Development of Croatia, which was approved, but poorly conducted and unfinished, require interdisciplinary analysis. The analysis should start with the unfavorable position of Croatia in terms of the density and speed of broadband access compared to EU average, as well as to the very unfavorable state of broadband in Slavonian counties compared to the average of Croatia. These facts provide a framework and direction for acting

to any professional expert or serious politician and other public persons. It should also be recalled that the development of broadband services is also an opportunity for the economic and technological development of local companies and employment of the local population to restrain the wave of emigration from Slavonia.

When Croatia started implementing the Digital Agenda of EU, the region of Slavonia was the first in the following [23, 34, 35, 37, 38]:

a. The first conference on broadband access in Croatia was held in Osijek (2012).

b. The first broadband access development project in Croatia for the area of more than one local community was launched in Osijek (2012).

c. The "Slavonian network" project was the best-ranked project for the development of broadband network by the Ministry of Regional Development of Croatia (2013) and was approved after the three expert analysis from expert teams of the Ministry (2014).

d. A stage for the mobilization and education of leaders and expert services for local units was planned in the "Slavonian network" project and a series of real measures to finance preparatory stages in the development of broadband network in the region (2014).

e. The interdisciplinary expert team (IET), which has conceived and developed the "Slavonian network" project, has a large number of expert references in national and international frameworks (2012–2017).

Pointing to the facts that:

1. FEE abandoned "Slavonian network" project and submitted it to the University of Osijek.

2. The University has appointed a new team without expert references for the implementation of the project.

3. The new project team showed an inadequate work, and finding only one culprit for the failure of the project does not make a great discovery. It does not contribute to finding a complete response to this problem and does not contribute to finding the direction for the necessary social action.

Namely, during the process of launching the "Slavonian network" project and during its development, five counties as well as dozens of cities and municipalities representatives were informed about the project by prefectures and expert services. Public debates and adoption of series of broadband documents in Croatia and articles in the media and TV provided enough information on the importance of broadband for development of local units. However, the municipalities' and cities' leaders in Croatia do not have technically educated experts in their work environment that would emphasize to them the importance of development projects. Other experts with social orientation don't understand such specialized professional materials or are not using opportunities for further education (lifelong learning). Thus, 4 years were lost for the development of broadband network in the area of eastern Croatia. These 4 years can cause further extensions and bring even more damage due to failure to implement the already adopted project. The towns and municipalities in the Slavonia areas were

unprepared and started late in the process of making BIDPs. From ignorance (or perhaps due to conformism) of local representatives, telecom companies have been given the option of investing in broadband from EU funds. This financial support can only be obtained by local units. In this way, these local units have reduced their development chances. Constructing broadband and rental and managing the local broadband network as well as its maintenance were great opportunities to raise technical level and economic development. It was a chance for awakened hope for the youth and to be one kind of horizon of better times, which would deter many young specialists from leaving Croatia and migrate to Ireland, Germany, Austria, Sweden, Norway, and other EU countries.

5.1. Structure of business problems

Immediately after taking the project from the University and forming a new team for the project "Slavonian network," the IET considered problems of further development of this project and published (2014) a paper, which hypothesizes the structure of business problems in implementation of infrastructure projects in Croatia, as outlined in **Figure 14**.

Technical issues evaluate for 10% in the structure of business problems in project implementation of launching the broadband in Slavonia. Legal problems in unfair real property relationships, regarding lands through which corridors of broadband are passed, are estimated to account for 25% of total business issue. Unsuitable financial resources and other economic issues were assessed as 30% of effort representation. However, the largest share of the difficulties in implementing the Slavonian network project, as well as in other infrastructure projects, are sociological (social) problems—which reach 35% of total disadvantage. The issue of social relations is also a crucial brake for the successful implementation of the "Slavonian network" project. Later analyzes and published papers assert this hypothesis [37, 38].

The reasons for this great and decisive influence of sociological problems in the realization of this project should be sought in the underdeveloped society, underdeveloped social relations, i.e., in unfinished transition processes toward civil society with the market economy. The same happens with economic initiatives as well as many infrastructure projects in Croatia. This situation is similar in other transition countries.

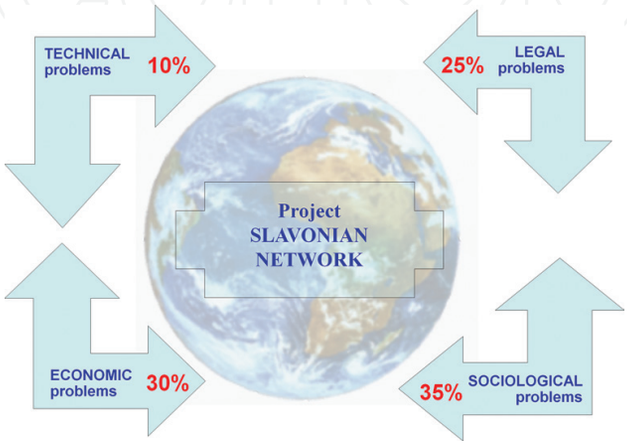

Figure 14. Structure of business problems in implementing the "Slavonian network" [35].

5.2. Economic interests and processes of regulation

Companies in the market economy are driven by economic interest—profit—and some of the authors here also include their derivatives such as social power or social reputation. In the realization of economic interests, one should distinguish individual, partnership, shareholder, and state interest. Business problems are solved in the market economy, and the results are obtained expost, only after the realization of the market. Therefore, for company business and project implementation in developed market economies, crucial knowledge about processes (technological, market, legal, etc.) and important stakeholders who have experts with references and results in practice are a must.

There are large, medium, and small businesses in each specific market of goods and services. In transition countries, in the social relationships in economic arena, as this part of society calls Lintz and Stepan [39], do not allow economic efficiency as in developed industrial countries. Namely, an educated civil society accepts known economic (and other) interests and roles of these large, medium, and small players; written and unregistered rules of conduct are known; and the participants adhere to them. This will mean that the market is regulated and close to market equilibrium, and within the framework of the national economy, the best results are achieved. In such an economic arena, big players will not endanger medium and small entrepreneurs; they will even cooperate with them, or small business owners will join forces in technology or marketing because of the cost reduction and because they are all aware of the division of the role and the need for all efficient people to participate in the market.

In the economic arena of transition economies, many interests are not transparent, written and unregistered rules are insufficiently respected, and the roles are hazy. In transitional countries, few of the participants in infrastructure projects take care of the whole spectrum of interests; personal and subjective interest is in the first plan solely. All this indicates that the market is not transparent, clear, and far from equilibrium; it can be said to be in a kind of chaos. Croatia, among other unsuccessful transitional countries, is a good illustration of our demands.

The desires for great profit in private companies have no boundaries, and therefore in the regulated countries, there exist regulatory mechanisms that do not allow a monopoly position in the market. This is particularly true of the telecomm sector. In transition countries, these regulatory mechanisms are only formal so that monopoly companies, lobbing in different even in nonpermissible ways in professional circles and government bodies, are able to skip the boundaries in earning profits for present and future times. Such are broadband services in Croatia, with the slowest speed in EU, being the most expensive between EU members at the same time. It should be noted first that employee salaries in Croatia are several times lower than the EU average, and second is that the unemployment rate in Croatia is among the largest in EU [37, 38, 40].

5.2.1. Conflicts of interest and systems of social regulation

People are less dependent on nature with the advancement of civilization and more and more dependent on society, on social relationships (and their technical systems). Written norms, laws and regulations, cannot cover or regulate everything, so that in regulated countries, social norms and social relationships are of increasing importance. That is why processes of transition to civil society are important [41, 42]. Unfortunately, although Croatia has become a member of EU, the transition processes have not yet been completed.

Civil society is pluralistic and there are legitimate interests of all individuals and groups. These interests are almost always in opposition and everyone is fighting for their own interest. From this, there are a number of conflicting relationships, e.g., worker—entrepreneur, officer—manager, rich—poor, old—young, employed—unemployed, modernist—traditionalist, etc. Many and different instruments of social regulation exist: legal regimes, peace-making, and reconciliation methods to a series of rules in social relations. One of these methods is the motivation to engage in affairs as a way of resolving conflicts of interest, which is not well known in the public and even in professional circles.

Economist Nobel Prize winner John Kenneth Galbraith wrote in his book "The New Industrial State" (1960s) about the business organization and (indirect) resolution of conflicts of interest. Describing a motivation system whose elements have been developed in human history, Galbraith distinguishes four motivational models for work engagement: (a) physical coercion, (b) financial reward, (c) identification, and (d) adaptation. Galbraith emphasizes that in modern terms physical compulsion in a business organization no longer exists and that monetary compensation as an individual's interest can be balanced, if employees are motivated by identification with a common goal, the benefit to the community, or motivation through the adaptation of the purpose function to use the business effects regarding their own affirmation and proving this in the environment (reputation in society) [43].

In this sense, the project "Slavonian network" is conceived not only as an infrastructure but also as a sociological project. Regardless of the regional name, the project has the ambition to give an example of community problem solving, and broadband access is certainly a must. The speed of implementation will also depend on the economic impact for all project stakeholders; these effects will be dispersed throughout the community, including business, education, service, culture, health, management, and any other activity, and the realization of the inclusion idea of every citizen in the e-citizen society.

5.2.2. Knowledge society

While the postsocialist countries are not dealing with rebuilding their unstructured society although some are successful and move on to development and some return to patriarchal and clerical ideas of the eighteenth century, the developed civil societies are transformed into a knowledge society and build a business based on knowledge.

The paradigm of contemporary civilization is a knowledge society that has four main pillars: knowledge economy, information society, networked society, and lifelong learning, **Figure 15**. The basic characteristics of the knowledge society can be described by analogy with the learning organization model: a continuous process in which society by producing and capitalizing on new knowledge is rapidly evolving in constant adaptation to new, increasingly brisk challenges in the environment. In doing so, the way of life, work, and acquiring knowledge quickly changes. In these processes, individuals are constantly learning and adapting rapidly to changes, but also the attitude of institutions to the environment changes and attempts to manage events (designing the future). At the same time, new structures and forms of production, transfer, and application of knowledge are emerging, including a large number of participants with a corresponding increase in the internationalized network-initiated context.

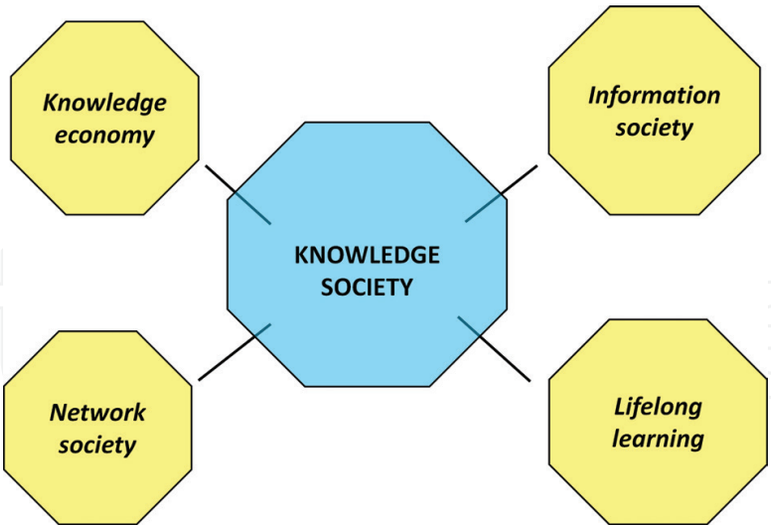

Figure 15. Main pillars of knowledge society [2].

Science and technology (in knowledge society) are in a continuous and reciprocal relationship, i.e., theory and practice are in dynamic interdependence that is rapidly anticipated in technological and organizational innovations; knowledge is capitalized pragmatically, and people are trying to learn and act more effectively in the team [1, 2].

Lifelong learning implies organized active education of people throughout the life span with a view to improving knowledge, skills, and abilities within a personal career and a civic, social, and/or business perspective. This learning implies acquisition and modernization of all kinds of knowledge and qualifications, from preschool until the end of the working age and even after retirement. In this concept, the development of knowledge and abilities allows people to adapt to life in a society of knowledge and active participation in all areas of social and economic life. The lifelong learning system is a basic prerequisite for the growth and development of society and the economy of knowledge.

Broadband infrastructure is a prerequisite for continuous learning. Some countries have already recognized this infrastructure that has become an integral part of formal education. We expect this to happen in the foreseeable future in Croatia as well. Some of the regions in Croatia in part of year have cut off from formal education, and through the realization of broadband projects, the inclusion of human resources will be enabled throughout the year and throughout the country.

5.3. Social problems in the implementation of infrastructure projects

Launching infrastructure projects—with a large number of participants, their various interests, with a small (but continuous) profit for the investor, with a great impact on the functioning of the community and good influence on GDP—is often subject to unpredictable influences on the mutual trust of project participants, i.e., social cohesion. Important elements of social cohesion are:

a. Trust in people and social institutions; this manifests itself in willingness to cooperate not only with family members or acquaintances.

b. Respect for social norms and legal regulations is shown by a smaller scope of political manipulation and less corruption.

c. Association and collective social activity: this is manifested by the experience of cooperation in the pursuit of interests outside the scope of an individual's ability.

These three elements are interrelated and affect one another, **Figure 16** [41, 42].

Contribution of a large number of sociologists points to the complexity of gaining mutual trust and the mentioned problem. The results of the research of the trust of individuals in the groups of people and institutions and of the hierarchy of trust in Croatia are decisively deviating from the results of similar research in well-organized EU societies. Realization of social cohesion in society is a process that is measured with decades [39, 41, 42, 44–47]. We point to these processes—because we recognized another problem the "Slavonian network" is facing—either in the light of project implementation priorities or in ensuring the size of the budget in the area of a local self-government unit. Disruption of social cohesion in this way could be reflected in the mistrust between political elites and the mistrust of citizens toward their political representatives. This could undermine the ongoing implementation of the project, and the continuity of project implementation is one of the conditions for the use of grants from EU funds.

If there is no social cohesion, then society is not using objective criteria for creating teams in project and business implementation. Instead of this, the criteria of loyalty to a political party, national, religious, or racial criteria are used. This is often in use by the mafias that are masked by patriotism and the interests of the nation or religion as well. Thus, in the case of the implementation of the "Slavonian network" project, many of the criteria listed in the selection of the new project implementation team, but only when the project was drafted and approved, were used only on the basis of criterion of expertise and proven references.

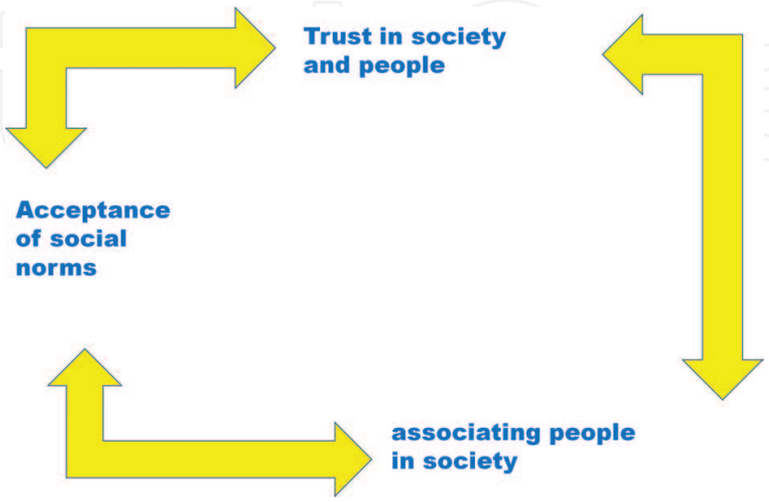

Figure 16. Complex structure of social cohesion [42].

Figure 17. Map of nöGIG broadband project in the Lower Austria region [48].

As an illustration of our ratings and as an example of the good practice, we have listed the Austrian example of the introduction of broadband in the Lower Austria region, nöGIG GmbH project, and later company, was winner of the 2016 European Broadband Awards competition in category no 4, openness and competition (**Figure 17**). "This 3 layer open project has public entities in the driving seat and is set on establishing an open, public infrastructure in underserved rural areas. nöGIG GmbH, a public authority coordinates planning and construction. The Broadband Coordination of Lower Austria (BBK) is in charge of the broadband strategy and allocation of public financial resources. Municipalities, private companies and service providers have cooperated to make this a successful open and public model." [48].

This project was started later than the Croatian project "Slavonian network." But it is already in high level of realization because local governments have recognized the initiative and supported it, and citizens have adopted the model and the project is being realized.

6. Model of broadband development for transition countries

During its efforts to realize the EU Digital Agenda and national broadband strategy, Croatia faced significant problems that make it difficult and in some cases delay the implementation of this project. Practice has shown that Croatia is significantly lagging behind in the implementation of the Digital Agenda, and the example of Slavonia region shows a number of important reasons. Since the beginning of the broadband application in Croatia, some telecomm companies have a strong influence on many local units and impose only issues of the construction of a network and an investment model, which is favorable only for their profit.

Since the beginning of the concept of broadband application in Slavonia, IET members have started to create a project with a spectrum of related themes, not just technological and construction goals. The project was conceived by several modules, the project modules were analyzed, the possibilities of their efficient realization were explored, and all the findings and solutions were published in professional circles and the general public. After a large number of practical examples and inductive conclusions regarding the broadband implementation in the Slavonia region (and Croatia), it is time for the synthesis. The basic conclusion at the paradigm level reads:

- Citizens (residents, their public services, and private companies) do not exist for the favor of telecomm companies and broadband, but the opposite is true: telecomm companies and broadband exist for the needs of citizens and should be at their service.

Therefore, broadband activities should involve citizens, i.e., their representatives and institutions. Of course, we are thinking of educated citizenship (their representatives), not of formalized involvement. Namely, according to the existing model, very unfavorable and dangerous distances in the opportunities for personal development of people and the development of local communities in Croatia are transferred from the past and the present to the future. These are (a) nontransparent business interests and aims of prominent individuals, interest groups, and individual companies; (b) an unhealthy imbalance in social relations that is at the limit of exclusion of a large number of people from all developmental processes; and (c) inequality of opportunity for access to modern communications. All this is transmitted to the future, but concealed with the goal of high communication technology.

In their works, Lintz and Stepan [39] pointed out at the beginning of postsocialist transition processes the possibility that the processes of democratization of society and the creation of an open market economy in some countries need not be completed. These countries will not build civil society, i.e., their societies will be in a kind of chaos with unhealthy imbalances. The economic situation in Croatia, as well as in a number of transition countries, and the very pronounced emigration of young people from these countries illustrate sufficiently anticipated processes.

The introduction of broadband is an opportunity for democratization of social relations, strengthening of transparency in the policy of technological and economic development. Broadband is through the process of preparatory stages an opportunity to simultaneously make a step in building social cohesion, steps toward a civic society, and a step toward the knowledge society. In these processes, it is very important to educate citizens and implement the concept of lifelong learning. And really broadband is one of the essential tools for that. This is not the question of what is older—chicken or egg (whether education first and broadband, or vice versa) but the matter of opportunity for simultaneous activities to make a leap into a higher quantum trait of social relations in the path of modern civilization.

It has already been said that practice has shown that local units have no skilled staff for broadband applications. This is true, but in the their universe only. And their universe is on the lower quantum trajectory, in the social relationships of the nineteenth century. In modern civil society, developed democracies with developed economies for decades have used think tanks in many areas of human life and work. Think tanks exist both at the international level and at the national and local levels [49]. However, the number and impact of think tanks on development policies in transition countries are minimal, unlike developed societies and

states. Democratic and developed societies use this model of nonpartisan, nonprofit, and independent teamwork by scientists and top experts [50].

Panon Institute from Osijek has manifested itself in the area of industrial strategy, broadband strategy, and renewable energy sources. Unfortunately, it is not recognized in the local communities of the Slavonia region.

7. Closing remarks

There is no single detailed recipe for planning and implementing investments in infrastructure installations, especially in the fast-growing technology sector. However, the basic professional framework must be taken into account, whereby the essential elements for the development and dynamics of the process will be determined according to local circumstances and the existing references.

Here are the experiences of the 5-year work of an expert interdisciplinary team that has so far successfully realized lot of national and regional projects of millions of values. Although the project has not been implemented (to the fullest extent) as conceived, and as approved by the Ministry, the experiences mentioned above are still precious. The established original development models, the simultaneous implementation of the module, the interdisciplinary problem-solving strategiesm and the transparency in the work that are outlined here can be used well in the development of broadband in other countries. And to young professionals, this can be good for a professional reading.

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