



ITU POLICY PAPER

ENABLING ENVIRONMENT FOR BROADBAND MAPPING IN BOSNIA AND HERZEGOVINA

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1. Introduction

This report examines conditions for establishing a working environment for broadband mapping in Bosnia and Herzegovina. The objectives of the report are to support the country's efforts towards strengthening its broadband mapping operations, to improve the deployment and uptake of connectivity throughout Bosnia and Herzegovina. In particular, the aim is to identify and empower key stakeholders to better perform the tasks described above.

To collect the needed data and elaborate this analysis, the report team has held several online meetings and phone calls with identified stakeholders having a direct interest in the Information and Communications Technology (ICT) sector, including policymakers from governments, regulators of the sector, networks and services operators and representatives of mapping authorities.

On each of these occasions, the ITU consultants delivered an online presentation and explained the best practices in their country of origin, Slovenia, to a wide variety of stakeholders from the ICT and public sectors of the country under study. This report summarises the views expressed in both the face-to-face discussions and from the completed questions and studies. Throughout the meetings, to allow for a frank and forthright discussion, stakeholders were asked to express their views in the strictest confidence. Many of their comments have been included in this report without attributing them to an individual or an organisation, therefore maintaining this confidentiality.

Online meeting dates and meeting participants			
Date	Meeting participants	Date	Meeting participants
16. 9. 2021	ITU, AKOS, RAK	15. 10. 2021	AKOS, RAK, FMPIK ¹
22. 9. 2021	AKOS, RAK	15. 10. 2021	AKOS, RAK, ITU
24. 9. 2021	ITU, AKOS, RAK	22. 10. 2021	AKOS, RAK, ITU
30. 9. 2021	AKOS, RAK	28.10.2021	AKOS, RAK; Telemach ² , BH Telekom ³ , Hteronet ⁴
1. 10. 2021	ITU, AKOS, RAK	29.10.2021	AKOS, RAK, ITU
4. 10. 2021	AKOS, RAK, FGU ⁵	4.11.2021	AKOS, RAK, MKT ⁶
5. 10. 2021	AKOS, RAK	5.11. 2021	AKOS, RAK, ITU
8. 10. 2021	ITU, AKOS, RAK	9. 11. 2021	AKOS, RAK, Mtel ⁷
11. 10. 2021	AKOS, ITU		
14. 10. 2021	AKOS, RAK, BHAS ⁸ , FZS ⁹		

¹ <http://fmpik.gov.ba/bh/>

² <https://telemach.ba/>

³ <https://www.bhtelecom.ba/en/home-english/>

⁴ <https://www.hteronet.ba/>

⁵ <http://www.fgu.com.ba/en/>

⁶ <http://www.mkt.gov.ba/>

⁷ <https://mtel.ba/>

⁸ <https://bhas.gov.ba/>

⁹ <http://fzs.ba/>

From a structural perspective, this report starts by examining the latest European Commission's guidelines and ambitions regarding digital connectivity and introduces the main European Union (EU)'s electronic communications policies and laws to present the European background regarding broadband mapping and help to set a customised path to reach the goal that will enable the environment for the country's broadband mapping. Bosnia and Herzegovina sees its further development for the future as a full member of the EU. In this regard, it signed the Stabilization and Association Agreement (2015). The process of European integration requires a comprehensive adjustment of policies, institutional framework and legal system in order to achieve European standards in the field of electronic communications. Furthermore, the process of legal harmonization and acceptance of European standards implies extensive internal reforms (i), general consolidation of the system (ii), stronger economic development (iii) and more intensive action in areas that affect the dynamics of relations between Bosnia and Herzegovina and the EU (iv). As the goal of Bosnia and Herzegovina is integration into European relations, the only logical approach is to present and follow as directly as possible (both in principle and in law) the guidelines that are already in use at the level of the EU.

Secondly, the report offers a countrywide assessment, tries to identify the justification for broadband mapping, delivers regulatory assessment, identifies relevant stakeholders and examines the current legal environments. Namely, the completion of the establishment of a broadband mapping system must be tailored to the target country, as successful (legislative and substantive) implementation of such a complex operation must take into account the specifics of the political structure of the country, its law and economy.

At the end, the report offers several proposals (i) and recommendations (ii) for enabling the environment for broadband mapping in Bosnia and Herzegovina and concrete actions (iii) for better institutional cooperation, data format specifications (iv) and technical solutions (v). This "core" part of the report is composed on the basis of an assessment of the situation and relations between (available) stakeholders, within the given possibilities, goals and accessibility of important parties, which proved during the preparation of the report to be particularly specific to Bosnia and Herzegovina.

2. Context of broadband mapping

2.1 Latest European vision, policy and activities relating to broadband mapping

To understand the links between Bosnia and Herzegovina and the activity of broadband mapping systems within the broader context of the European vision in the field of telecom, it is necessary to take a step back and clarify certain elements.

Over the past six years, since Bosnia and Herzegovina and the EU initialled the Stabilization and Association Agreement (SAA) (June 1st, 2015), the country has worked to strengthen its position vis-a-vis to the EU and to transform its interest in joining the Union by addressing required reforms in different fields to mirror the EU standards. Among those, the telecom sector is seen as critical to a successful accession and more specifically broadband mapping system is expected to be required given the latest EU policy and activities in the telecom field.

In this context, Bosnia and Herzegovina has implemented two regulatory reforms in the field of telecommunication, following the EU directives, such as the INSPIRE recommendations. The first reform is the “Ordinance on Infrastructure and Special Data Planning of the Federation of Bosnia & Herzegovina”, issued in the Official Gazette of FBiH (1845/2014 86) and the second is the “Rule on Method for Establishment and Maintenance of Network Cadastre”, published in Official Gazette of RS (58/2012). Based on those, two distinctive geoportals for broadband mapping systems use were designed to provide access to transparent ‘spatial data’ and to operate within the context of broadband mapping systems in Republic of Srpska and in the Federation of Bosnia and Herzegovina. This evidence, once again, shows RAK’s commitment to align its prerogatives and operations with the EU, also in light of recent updates.

As a matter of fact, on 9 March 2021, the European Commission (EC) updated its previous vision and policy actions to turn EU into a Gigabit Society by 2025 by presenting a vision and avenues for EU’s digital transformation by 2030. This Digital Compass for the EU’s digital decade evolves around four cardinal points, i.e., Digitally skilled citizens and highly skilled digital professionals (i); Secure, performant and sustainable digital infrastructures (ii); Digital transformation of businesses (iii); and finally, Digitalisation of public services (iv).

The second cardinal point, which mostly covers the area of the work of this report, is the Commission Communication regarding excellent and secure connectivity for everybody and everywhere in Europe. This is a prerequisite for a society in which every business and citizen can fully participate. Achieving gigabit connectivity by 2030 is key and, although this ambition can be reached with any technology mix, the focus should be on the more sustainable next generation fixed, mobile and satellite connectivity, with Very High Capacity Networks (VHCN) including 5G being rolled out. Swift and efficient allocation of the spectrum should be achieved and respect the 5G cybersecurity toolbox, and with 6G being developed in the years to come. In general, the proposed level of ambition by 2030 is that all European households will be covered by a Gigabit network, with all populated areas covered by 5G. This ambition continues on the track proposed by the 2016 Commission Communication ‘Connectivity for a Competitive Digital Single Market – Towards a European Gigabit society’ and the 2025 targets set as well.

The EU has already taken action in a range of areas to improve connectivity, especially by introducing the European electronic communications code, which sets clear rules applicable across all of Europe.

On the 15th of September 2021, the EC announced¹⁰ the adoption of the policy programme "Path to the Digital Decade", proposed by the EC to deliver the EU's digital transformation by 2030! The "Path to the Digital Decade" aims to ensure that the EU achieves its objectives and targets towards a digital transformation of our society and economy in line with the EU's values, reinforcing our digital leadership and promoting human-centred, inclusive and sustainable digital policies empowering citizens and businesses. To this end, the "Path to the Digital Decade" sets out the concrete digital targets which the EU, as a whole, is expected to achieve by the end of the decade, as first delineated in the Digital Compass Communication. The digital targets for 2030 are based on four cardinal points: digital skills, digital infrastructures, digitalisation of businesses and of public services.

This European effort to accompany its citizens into the digital world would require among other instruments, the extensive adoption of broadband mapping systems at the national level to reach the gigabit society. Indeed, broadband mapping systems are essential as the EU envisions the Digital Single Market, or the European Gigabit Society, in which "availability and take-up of VHCNs enable the widespread use of products, services and applications in the Digital Single Market" as mentioned in. As a result, not only the EU countries are following this path, but also non-EU countries are doing the same, such as the case of Bosnia and Herzegovina.

2.2 Key electronic communications laws and guidelines related to broadband mapping

In this subchapter, the report introduces the key EU's electronic communications policy and laws that aim at improving competition, driving innovation, and boosting consumer rights within the European single market. The report focuses on policies and laws connected to broadband mapping in means of deeper understanding and detailed background that may provide a framework within which a regulatory environment for broadband mapping in Bosnia and Herzegovina might be established. The following is not written in order of importance or chronological order. Rather, it provides an overview of the existing policies and laws related to broadband mapping.

2.2.1 European Electronic Communications Code

The European Electronic Communications Code¹¹ (EECC) redefines the regulation of electronic communications in Europe. Member States have to transpose the EECC into national law by 21 December 2020, two years after entry into force. Although some European

¹⁰ Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme "Path to the Digital Decade", COM(2021) 574 final, 15.09.2021.

¹¹ Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code, OJ L 321, 17.12.2018, p. 36.

countries are still at an early stage (unless an earlier date was indicated for specific provisions). EECC will improve regulatory conditions to incentivise private investments for the deployment and take-up of VHCN. The timely and investment-friendly access to the 5G radio spectrum is also addressed in the EECC, which provided for some concrete deadlines for the assignment of the 5G spectrum by June and December 2020.

The Code puts emphasis on access to civil infrastructures, such as masts, ducts, and cabinets. Such access will significantly lower the cost that smaller players have to incur for deploying their own networks. Besides this, EECC focuses also on VHCN – definition and co-investment, market analysis, symmetric access, SMP and non-SMP remedies, spectrum and small-cell deployment, the redefinition of electronic communications services, end-user protection, universal service – scope, affordability and funding, governance and BEREC.

2.2.2 BEREC Guidelines on geographical survey of network deployments

Article 22(1) of the EECC establishes that National Regulatory Authorities (NRA) and/or Other Competent Authorities shall, by 21 December 2023, conduct a geographical survey of the reach of electronic communications networks capable of delivering broadband, and shall update it at least every three years thereafter. This geographical survey may also include a forecast of the reach of broadband networks, including VHCN, for a period determined by the relevant authority. The rationale underlying Article 22 is the idea that geographical information on the reach of broadband networks will become an important tool to enable the effective design, implementation and monitoring of broadband policies and related regulation. The rationale underlying Article 22 is the idea that geographical information on the reach of broadband networks will become an important tool to enable the effective design, implementation and monitoring of broadband policies and related regulation.

2.2.3 Broadband Cost Reduction Directive

Within the EU, the Broadband Cost Reduction Directive (BCRD)¹² constitutes a critical piece of legislation that aims to facilitate and incentivize the roll-out of high-speed electronic communications networks. The BCRD promotes measures for facilitating the joint use of existing physical infrastructure and more efficient deployment of new physical infrastructure at a lower cost. BCRD can be described as an instrument, theoretically consisting of four pillars that allow or facilitate cost reductions when setting up new telecommunications networks.

In the context of the preparation of this report, it is necessary to emphasize the first, basic pillar – “Access to existing physical infrastructure & Transparency concerning physical infrastructure”. The Directive is also legislating the concept of Single information point, which provides access to minimum information concerning physical infrastructures available in the areas of deployment.

Member States have implemented the 2014 Directive into their national rules. The 2018 Commission’s report on the implementation of the BCRD revealed a number of problems in

¹² Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks, OJ L 155, 23.5.2014, p. 1.

terms of its efficiency and consistent implementation. In 2020, the Commission launched the process for reviewing the BCRD. The Commission carried out an evaluation of the current measures under the BCRD and an impact assessment of a new Commission legislative proposal. WIK-Consult, together with ICF and eco-act, has been tasked with providing support to the EC on the review of the BCRD, through a study (VIGIE 2020-0647) which provided input to the evaluation of the current Directive and to the impact assessment of a potential new legislative instrument.

2.2.4 The Connectivity Toolbox

In September 2020, the Commission adopted a Recommendation¹³ calling on Member States to boost investment in very high-capacity broadband connectivity infrastructure, including fibre and 5G. The aim of the Recommendation is for Member States to develop a common EU Toolbox of best practices for reducing the cost of deploying electronic communications networks and for efficient access to 5G radio spectrum. The Member States would share their experiences with each other in order to focus their actions on measures that work best in rolling out advanced networks. Part of the recommendations and toolbox are the best practices concerning the information regarding existing physical infrastructure and broadband mapping. Common EU Toolbox for Connectivity¹⁴ was agreed upon by Member States in March 2021.

2.2.5 State Aid rules for broadband infrastructure deployment

On 7 July 2021, the European Commission (EC) published a report¹⁵ summarising the results of an evaluation of the EU's State aid rules for the deployment of broadband networks¹⁶.

Since 2013, in the field of telecommunication, the EC has developed and produced extensive knowledge on the subject of broadband mapping systems. The State Aid Guidelines of that year underlines how broadband connectivity will play a crucial role in fostering European economic growth and technological advancement. Implementing a successful broadband development strategy across the continent, as also stated in both the Digital Agenda for

¹³ Commission Recommendation (EU) 2020/1307 of 18 September 2020 on a common Union toolbox for reducing the cost of deploying very high-capacity networks and ensuring timely and investment-friendly access to 5G radio spectrum, to foster connectivity in support of economic recovery from the COVID-19 crisis in the Union, OJ L 305, 21.09.2020, p.33.

¹⁴ Common Union Toolbox for Connectivity (2021) pursuant Commission Recommendation (EU) 2020/1307 18.09.2020 on a common Union toolbox for reducing the cost of deploying very high capacity networks and ensuring timely and investment-friendly access to 5G radio spectrum, to foster connectivity in support of economic recovery from the COVID-19 crisis in the Union

¹⁵ Commission Staff Working Document Evaluation of the State Aid rules for broadband infrastructure deployment, SWD/2021/0194

¹⁶ Communication from the Commission — EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks, 2013/C 25/01

Europe (DAE)¹⁷ as well as in the Europe Strategy (EU2020)¹⁸, would bring socio-economic benefits to the population with the adoption of affordable access to high-speed internet infrastructure and services. The State Aid Guidelines of 2013 tries to maximise the chances of this result by tackling possible market failures and enhancing market delivery by affirming that public policy intervention supports the deployment of broadband networks such as the case for rapid roll-out of broadband or the deployment of next generation access (NGA) networks.

One element worth mentioning in the State Aid Guidelines is in the principles of compatibility (Art.2.5). One of these principles, i.e., Appropriateness of State aid as a policy instrument underlines how “Public intervention in support of broadband networks may take place at State, regional or municipal level”, meaning that Member States are encouraged to build their own schemes and identify the specificities of the planned networks. In this context, NRAs are highlighted as supportive actors for such interventions that they have technical knowledge and expertise and can advise effective measures to be adopted. The National Competition Authorities’ work, on the other hand, can assist in preserving market competition, abiding by and applying the minimum intervention principle, by setting up the legal framework for the bidding scheme to take place and prevent high share of one recipient of State funds. Moreover, the importance of adopting a broadband mapping system and the role the NRA plays in achieving such result is mentioned in the article 3.4, i.e., Design of the measure and the need to limit distortions of competition. Among the different subparagraphs of this article, the subparagraph (a), Detailed mapping and analysis of coverage, and (i), Monitoring and clawback mechanism define that any EU Member State is encouraged to be equipped with a central database collecting information on the existing available broadband infrastructure to save costs ahead of future related projects the supervision may be assigned to the NRA, to entirely monitor the implementation of the broadband mapping systems up to its use.

State subsidy rules on the broadband sector aim to support the deployment of high-speed broadband networks that are competition-driven. This ensures that public funding is steered towards areas that need it most (mainly rural and remote regions) and prevents private investment from being crowded out.

2.2.6 The SMART Project

One of the biggest projects directly related to mapping is a project called “Mapping of Fixed and Mobile Broadband Services in Europe (SMART 2014/0016)” which has been initiated in January 2016 with the objective to develop the first European-wide integrated monitoring platform on the internet connectivity. The EC has developed this online platform in order to

¹⁷ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2010) 245 final, *A Digital Agenda for Europe*.

¹⁸ Communication from the Commission Europe 2020, COM(2010) 2020, *A strategy for smart, sustainable and inclusive growth*.

monitor the progress made in the deployment of high capacity networks. The information is derived via theoretical calculations and measurements. The project has developed three data categories for “Quality of Service (QoS)”:

- QoS-1: Calculated availability of Service - Theoretical calculations of coverage by network operators
- QoS-2: Measured provision of Service - Measurements via panel probes or drive tests, not taking into account the end user’s environment
- QoS-3: Measured experience of Service - Measurements via online speed tests, including end user’s environment / actual user experiences

The project builds on existing mapping initiatives. The data is provided on a voluntary basis by Member States’ public authorities as well as from operators of private mapping initiatives and operators of crowdsourcing applications and could present a good approach to benefit from. Methodologies and focuses of QoS mapping initiatives vary across Europe that is why the comparability is assessed by means of comparing descriptive metadata.

2.2.7 The INSPIRE directive

The INSPIRE Directive¹⁹, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment entered into force in May 2007. It brought the obligation to EU Member States to establish infrastructures for spatial information that are made compatible with common implementing rules and are supplemented with measures at a community level. The EU Member States should provide access to their infrastructures through a community geo-portal operated by the EC, as well as through any access points they decide to operate.

In order to achieve a certain level of interoperability, which is needed to bring all national or regional spatial data infrastructures together, INSPIRE lays down several technical specifications which regulate the technology, and the standards the involved data providers should use. By doing so it enables everybody to communicate in the same way using terminology and models everybody understands.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). These IRs are adopted as Commission Decisions or Regulations and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Member States and chaired by a representative of the Commission (this is known as the Comitology procedure).

¹⁹ Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

2.3 European good practices regarding broadband mapping system

To provide insight into how the legislation and guidelines outlined in the previous section translate into regulatory actions that serve countries' connectivity objectives, this section outlines examples of relevant practices enabled by broadband mapping regulation.

Bosnia and Herzegovina, as the target country of this report, can gain significant time over the implementation of the necessary mapping steps by applying good practices and anticipating the challenges already identified. The objective for Bosnia and Herzegovina, which still has a long way to go in developing and harmonizing its regulatory framework, should be to leapfrog EU countries and reach state-of-the-art systems which are simple enough and are thought to directly support the implementation.

In the process of improving the BCRD, and specifically during the preparation of the Connectivity Toolbox, intensive communication and attempts to identify best practices between the countries of the EU took place. These also largely covered the field of broadband mapping. During the preparation of the Connectivity Toolbox, extensive questionnaires and subsequent work of the set working groups were carried out. In this way, three important factors in the implementation of quality broadband mapping were first identified. In the context of these factors, good approaches (as well as challenges and potential problems) were further identified and highlighted, which are also useful for the implementation of the task as set out in this report:

a) **Providing information on data concerning physical infrastructure** across countries in Europe is not uniform; therefore, the current situation in different countries can generally be divided into three categories:

- Some countries have made a mandatory obligation for all (public and private) network owners and operators to provide the data in question via operable Single information Point - SIP (Austria, Belgium, Denmark, Finland, Germany, Italy, Latvia, Netherlands, Portugal, Slovenia).
- In some countries, public sector bodies are excluded from former obligations, or the obligation is not mandatory, following different reasons, usually because of the unavailable data, but information can be provided upon request if available (Czech Republic, Spain, Ireland, Romania, Sweden).
- Other countries have implemented legal mechanisms, but the functionality of their SIP is not completed (Greece, Croatia, Slovakia).

b) **Legal mechanisms**, which ensure information from public sectors bodies is available via SIP, are in most cases built into a national or federal Act (Electronic Communications Act, Building Act or separate Act that is direct transposition of BCRD) or federal provisions. Concerning technology, other than providing data to SIP, some Member States approve other means of informing, such as municipality or operator webpage. Some countries (Austria, Greece, Finland, Italy, Latvia, Portugal, Slovenia) have a legal requirement for network operators for making information on the existing physical infrastructure available to other operators via SIP in electronic format.

c) Best practices regarding the **availability of georeferenced information** (maps/digital models) within the EU States are as follows:

- geo-information system accessible via browser (Spain, Slovenia, Portugal), including different georeferenced information (i.e., public held physical infrastructure / optical fibre networks / coverage levels / with economic data on investments / ongoing tenders or public).
- use of Web Mapping Service (WMS) and Web Feature Service (WFS) technologies (Austria, Hungary, Slovenia), data available through web-based geospatial information services, which can serve data requests in real time through online data links.
- physical infrastructure presented on map interface based on Open Street Map and incorporate base map layers from land registry and national orthophoto database (Austria, Hungary).
- geo-referenced geometric data on the infrastructure above and below ground, both private and public. All the data collected are made available through visualization services (Italy).
- preloading of geometric information related to the land register in addition to the administrative limits at regional, provincial and municipal levels (Italy).
- all physical infrastructure registration objects characterized by their administrative location and geo-referenced coordinates, by using a unique reference system (and the conversion to it), transfer formats, metadata, base cartography, administrative delimitation information and toponymy codification (Portugal).
- geo-referenced information system accessible via browser or Representational state transfer (REST) interface including scalable maps, forming a uniform geographical topographical basis for the location of planned civil works and possible coordination requests during the construction (Finland, Slovenia).
- geo-referenced geometry data modelled as points, lines or areas (Austria, Portugal, Germany, Slovenia), information on locational accuracy, information on the timeliness of data, industry affiliation of the infrastructures, information of installations using public funding for broadband roll-out, email and phone of the person designated in relation with the shared use of infrastructures (in some cases in the future (GIS Tool) also broadband roll-out, future network roll-out, construction sites and public sector properties).
- information on aboveground, according to various layers provided by the INSPIRE Directive (Italy, Slovenia) (e.g., roads, railways, buildings, artifacts - address management, toponyms and house numbers; orography - digital terrain models) this information is gathered from local geographic databases (spatial planning tool of regional/local authorities), into the unique database SINFI (Italy);
- provision of active network infrastructures (Germany, Denmark, Slovenia) location and property of underground cables;
- digital maps models (vectorial, raster and satellite views) (Portugal);
- provision of “state of occupation” field, allowing filling with indicative information (%) of capacity (Portugal).

2.4 Slovenian broadband mapping experience

There are different reasons why the Slovenian experience has been leveraged by ITU in this policy paper aimed for the National Regulatory Authority RAK. First of all, the exercise of assessing Bosnia and Herzegovina's broadband landscape needed an already existing

experience, which Slovenia could leverage; secondly, for many years now, a well and consolidated collaboration established between ITU and the Slovenian National Regulatory Agency AKOS exists; and finally, ITU's decision to leverage Slovenian experience stems not only from this ongoing collaboration, but also from the geographical ties that exist between Slovenia and Bosnia and Herzegovina.

The stakeholders involved in Slovenia's mapping project were: The Surveying and Mapping Authority of the Republic of Slovenia, Ministry of the environment and spatial planning, The Agency for Communication Networks and Services of the Republic of Slovenia (AKOS) and The Directorate for the Information Society, Ministry of Education, Science and Sport.

The Spatial Planning Act in Slovenia was adopted in Slovenia in 2002 (Official Gazette of the RS, No. 110/2002). The Spatial Planning Act defined the responsibilities and procedures in spatial planning and the types and contents of spatial documents at the national and local levels. The Act also provided a legal basis for the adoption of the basic strategic spatial planning document, namely the Spatial Development Strategy of the Republic of Slovenia (Official Gazette of the RS, No. 76/2004). The Cadastre of Public Infrastructure system was established in 2005 and development continued in 2006. The legal basis for spatial planning is the Spatial Planning Act (Official Gazette of the RS, No. 33/2007), which replaced the Spatial Planning Act from the year 2002. The Act clearly regulates the system of national spatial planning documents and their interrelation, and precisely defines their contents, adoption procedures and, within this framework, the procedure of integrated assessment of their environmental impacts.

The Slovenia Electronic Communications Act contains several articles relative to building infrastructure. Article 14 requests operators to provide data of their network termination points and it provides the legal basis for adopting a general act concerning entry, collection and access to data in the register of infrastructure. Article 15 of the Electronic Communications Act gives supervisory power to AKOS and the possibility to fine owners of infrastructure if they do not provide data or if they provide incomplete or incorrect data. Data needs to be provided directly to the Surveying and Mapping Authority of the Republic of Slovenia.

Network termination points, which are collected through this new mapping procedure, means the physical point at which a subscriber is provided with access to a public communications network. In the case of networks involving switching or routing, the network termination point shall be identified by means of a specific network address, which may be linked to a subscriber number or name.

AKOS has established a database for all available inputs, including additional data collected from owners of electronic communications infrastructure, in order to get a complete picture of the networks available in Slovenia. The advantages of having this database include:

- reusing already collected data;
- adding different information and various other databases, such as fixed wireless broadband access (FWBA), base stations, MDF data (main distribution frame);
- faster responsiveness in accessing information;
- more flexibility on queries to be formulated;

- use of open-source software.

Slovenia uses open source and other available free tools, including PostgreSQL and PostGIS as spatial database extenders, which support geographic objects allowing location queries to be run in SQL. For analysis and complex research, AKOS is using Geographic Information System (QGIS) and have developed their own interface.

AKOS also presented publicly available geoportal called Geoportal AKOS in detail and usage of geospatial data in the field of market analysis and geographical segmentation, universal service (connection to the fixed public communication network and access to publicly available fixed telephony service), postal contact points, defining white spots, providing support to policymakers and many other beneficial usages.

3. Country wide assessment and justification for broadband mapping

3.1 Geographic and institutional overview

This subsection only presents general country data. However, the report also includes a brief explanation on the specific institutional situation on the country of the study as it also has significant impact on the topic of the report and recommendations later in the paper.

The most important institutional-structural exceptionality of Bosnia and Herzegovina is the division of the state into two entities, each of which covers approximately half of the country's area: the Federation of Bosnia and Herzegovina and the Republika Srpska. In addition to both and outside the mentioned entities, the Brčko District in the north of the country was later created (it officially belongs to both, but it is not managed by either and operates within the decentralized system of local government). Since 1996, the power of entities has decreased significantly relative to the state government - nonetheless, entities still have numerous powers to themselves.

The Federation of Bosnia and Herzegovina is decentralized; it is administratively divided into 10 cantons, which are further divided into 79 municipalities (općine). The Republika Srpska is relatively centralized and is administratively divided into 64 municipalities (opštine). Municipalities also have their own local government and are typically based on the most significant city or place in their territory. Citizens of both entities directly elect mayors and representatives to municipal and cantonal assemblies. Bosnia and Herzegovina's complex system of governance helps maintain an institutional balance between communities but, without adequate co-ordination, creates scope for significant inefficiencies.²⁰

Bosnia and Herzegovina has a largely mountainous terrain. The Dinaric Alps dominate the western border with Croatia, and numerous mountain ranges run through the country, generally in a northwest-southeast direction. The uplands are often bare and denuded. Elevations of more than 1,800 metres are common, and the plateaus descend abruptly toward the Adriatic Sea. The coastline, limited to a length of 20 km along the Adriatic Sea, is bounded on both sides by Croatia and contains no natural harbours. The arid plateaus in the southern region are less populated than the more hospitable central and northern zones.

In the field of connectivity and telecom perspective, the terrain obstacles and non-dense population inevitably lead to the use of older technologies, slower data and/or higher prices since local operators are struggling with costs. In the rural areas, where more than half of the population lives, people tend to use lower speeds and higher cost connections for technical reasons.

3.2 Economic and telecom market overview

The economic development of Bosnia and Herzegovina is largely dependent on the country's continuing integration with the EU. GDP growth was inconsistent for several years before 2015, since when the economy had grown at above 3% annually. The measures taken to

²⁰ OECD, Multi-dimensional analysis of development in Bosnia and Herzegovina, <https://www.oecd-ilibrary.org/sites/8e6d1ccd-en/index.html?itemId=/content/component/8e6d1ccd-en#chapter-d1e28690>

address the spread of Covid-19 in 2020, which affected trade and tourism, led to GDP growth being negative 5.5% in 2020, though the IMF anticipated that growth of 3.5% was possible for 2021. This is predicated on the virus being controlled, and a return to normal economic activity. There nevertheless remain some significant challenges, not least of which is high unemployment which continues to hinder the country's economic growth potential, including the growth of the telecom sector, as described in more detail in later paragraphs.

The telecom market has been liberalised and a regulatory framework created based on the EU's regulatory framework for communications. Although Bosnia and Herzegovina remains an EU candidate country, in July 2017 it applied amended mobile roaming charges to fit in with changes introduced across the EU. Further roaming agreements were made in 2019 with other western Balkan countries.

The market structure is peculiar as it is characterised by three zones, each with an incumbent telco. The largest operator BH Telecom is the dominant provider, while Telekom Srpske operates in Republika Srpska and HT Mostar is active in Herzegovina. Together, these three incumbent operators control 99% of the market.²¹ The business segment is a competitive national market, but the residential market is still entity and ethnic-based. The three incumbent operators are subject to regulatory obligations to improve competition, they continue to operate as de facto monopolies in fixed and mobile voice telephony in their geographical areas, whereas competition is emerging in the fixed broadband market.

Following the data from 2020, 70% of the population of Bosnia and Herzegovina is using the internet. The fixed-line broadband network is comparatively underdeveloped, recording a 22% penetration of fixed broadband. Internet services are available through the incumbents and a number of alternative operators. DSL and cable are the main platforms for fixed-line connectivity, while fibre broadband as yet has only a small market presence.²²

As a future candidate for EU membership, Bosnia and Herzegovina is entitled to access Instruments for Pre-accession Assistance (IPA). In fact, in the past, Bosnia and Herzegovina was allocated certain funds under this title, but none of the IPA programs in the past included infrastructure projects. Consequently, roll-out fixed networks are currently dependent on operator funding, resulting in network development only in urban areas with economic viability.

Investments made in mobile upgrades by BH Telecom and Telekom Srpske are facilitating broadband connectivity in the country to a greater extent than is common elsewhere in Europe. On the other hand, the forecast for overall broadband market growth up to 2023 is very low, at only 1.6% per annum; specifically, fixed broadband is expected to grow at 4% per annum²³.

On the consumer side, spending on telecom services and devices is under pressure from the financial effect of large-scale job losses and the consequent restriction on disposable incomes. However, the crucial nature of telecom services, both for general communication as well as a tool for home-working, will offset such pressures. In many markets, a steady increase is found

²¹ BuddeComm (global independent telecommunications research and consultancy company)

²² Telecommunication indicators in BH for the year 2020

²³ Sources: UN, ITU, Speedtest Global Index, Fitch Solutions

in subscriber growth, though it does not progress as fast as estimated due to the reasons mentioned above.

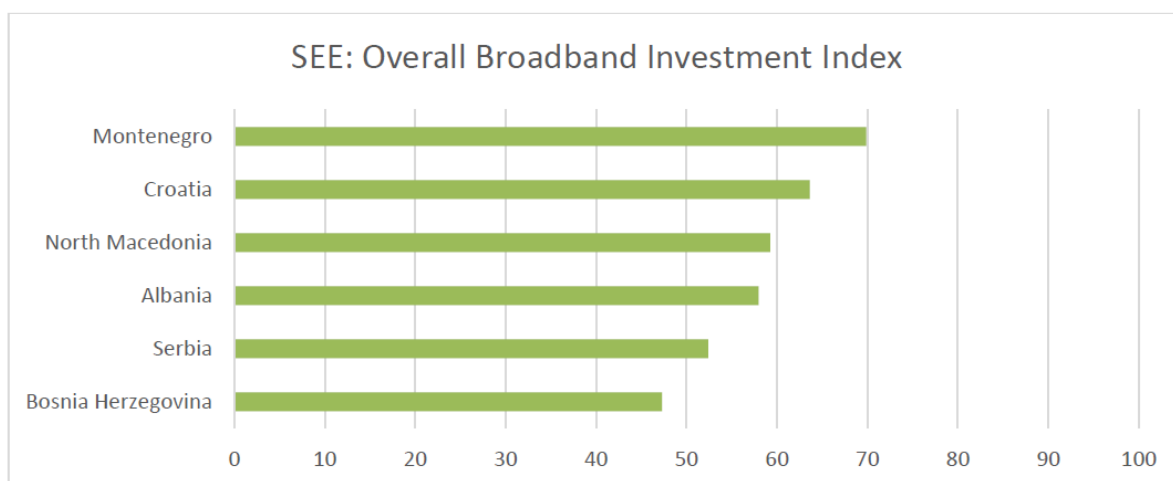


Figure 1 Overall Broadband Investment Index in South Eastern Europe(SEE) Region [Retrieved from EBRD (2020), *Investor Perceptions and the Broadband Sector- A survey by the European Bank for Reconstruction and Development*]

According to EBRD data, Bosnia and Herzegovina is a disjointed market with regulatory and political risks for broadband investments in the broadband market, making it the least appealing country in Southeast European region (falling behind Montenegro, Croatia, North Macedonia, Albania, and Serbia)²⁴.

Notable investment risk factors, important to this report, were also the Legal and regulatory framework for broadband, joined with the Quality of databases and access to information.

One of the key weaknesses of the market is also an unclear national ICT market strategy with stated ambitions and goals for the country, for example, targets for broadband coverage and take-up. An appropriate document for the subject area is being prepared, with the working title “Framework strategy for the development of broadband approach in Bosnia and Herzegovina for the period 2019 – 2023”. However, it is still not adopted and a public debate is underway).

3.3 Broadband mapping developments in Bosnia and Herzegovina so far

Even though Bosnia and Herzegovina was encompassed by the Franciscan Cadastre already in the 19th Century (today’s territory of Croatia, Slovenia, Hungary, Austria, Bosnia and Herzegovina, Slovakia, Czechia and parts of some neighbouring countries), Bosnia and Herzegovina, unlike other Yugoslavian republics, did not have special civil institutions for cartography except Geodetic Institute in Sarajevo which was established in 1975. A few years after the disintegration of Yugoslavia did the Geodetic Institute in Sarajevo start reproducing topographic maps, whose originals were done in Belgrade. Basic state maps in the scope of 1:5000 and 1:10000 were done in 1992.

²⁴ EBRD Survey of Investor Perceptions and the Broadband Sector, 2020

In line with the guidelines of the INSPIRE Directive, two general infrastructure geoportals have been created in Bosnia and Herzegovina, each covering the internal structural entity division of the State:

- **Geoportal of the Federation of Bosnia and Herzegovina**²⁵ is operated by Federal Administration for Geodetic and Real Property Affairs of FBiH. It currently includes the following data: a) 1:5000 orthophotos of the Federation of Bosnia and Herzegovina; b) boundaries of the Federation of Bosnia and Herzegovina, its cantons, and municipalities; c) main road routes in the Federation of Bosnia and Herzegovina; d) watercourse network of the Federation of Bosnia and Herzegovina.

- **Geoportal of Republic of Srpska**²⁶, which is operated by Republic administration for geodetic and property affairs of the Republic of Srpska. It currently includes administrative units; Register of geographical names; Coordinate reference systems; Cadastre; Address register; Geological maps; Protected areas; Statistical units; Hydrography; Orthophoto; Topographic maps and heights.

So far (and as can be seen from the forementioned layers), in Bosnia and Herzegovina broadband mapping has not been leveraged to concretely support the development and deployment of electronic communications services in the country. It is expected that more activities could be detected on the part of operators who need (also geographically appropriate) data on their network, capacity, users, investment plans for their own business.

The next section will look at the current regulatory environment in Bosnia and Herzegovina to understand what arrangements and settings might be implemented in the country, thus enabling the improvement of the telecommunication sector.

²⁵ <http://www.fgu.com.ba/en/572.html>

²⁶ <https://geoportal.rgurs.org/>

4. Regulatory assessment in Bosnia and Herzegovina

4.1 Identified relevant stakeholders

During the analysis, the listed stakeholders below have been identified to be crucial and important when implementing broadband mapping in Bosnia and Herzegovina. The focus was to establish the first communication at the level of the federation, as there was limited success establishing contact in Republika Srpska and in district Brčko. With identified relevant public institutions and operators as owners of electronic communications infrastructure, several meetings were held to present the Slovenian experience of broadband infrastructure mapping. Hereby, the report shortly describes the roles and parallels that were identified after the discussions and presentations during the meeting.

One point worth mentioning is that telco actors are not only involved in regulatory activities pertaining to telecom services, but they are also the owners of telecom data. Given the nature of this exercise, broadband mapping, the use of the word data in this report implies telecom data. To avoid redundancy, it has been agreed that using the word data is sufficient.



Figure 2 Categorization of stakeholders of broadband mapping in Bosnia and Herzegovina

4.1.1 RAK – The Communications Regulatory Agency (CRA)²⁷

The Agency is a regulator with combined competencies, developed on the model of similar processes in other European countries, and reflects the convergence of technologies in telecommunications and broadcasting in a way that can respond to market needs. In accordance with the Law on Communications of Bosnia and Herzegovina, the Agency's competences are: the development and promotion of rules in the sectors of telecommunications and broadcasting (i), the licensing of operators in the broadcasting and telecommunications sectors (ii), the planning, management and allocation of the frequency spectrum (iii), the implementation of technical and other standards related to quality (iv), and the establishment and maintenance of license fees (v).

RAK annually manages the data concerning the number of subscribers by type and speed of access, as well as additional services offered by the cantons and cities in the country. Broadband penetration data is gathered on the level of municipalities.

The Agency should play a central connecting role in the process of establishing broadband mapping. Namely, geo-mapping allows the agency to process data at a higher quality level, which improves (or even enables) the implementation of national legislation, policies and development policies. On the other hand, the data that the agency already has and collects must be georeferenced in order to change them from general statistics into data that are useful for business users, investors and end-users, consumers.

4.1.2 The Federal Administration for Geodetic and Real Property Affairs of FBiH²⁸

The Federal Administration for Geodetic and Real Property Affairs of FBiH performs administrative and other technical tasks that are under the authority of the Federation of Bosnia and Herzegovina, relating to: survey, real estate cadastre establishment and updating, utility cadastre, with the exception of the tasks for which the authority was devolved by the law to the cantons and municipalities, mapping of the territory of the Federation of Bosnia and Herzegovina, geodetic and cartographic tasks of relevance to defence, keeping technical archives of the originals of plans and maps of basic geodetic works and other data resulting from geodetic works, land consolidation, special purpose land survey, real property records, making property reprivatization proposals, inspection supervision of works related to survey, real estate cadastre, land cadastre, and utility cadastre. The geodetic profession in the Federation of Bosnia and Herzegovina is decentralized with its headquarters in Sarajevo, in contrast to the Republic Administration of the Republika Srpska that is headquartered in Banja Luka. Both Administrations cooperate on a legislative and professional basis and are partners in various projects and programs. In addition to the Federal Administration for Geodetic and Real Property Affairs of FBiH, there are also four cantonal-level standalone geodetic administrations, and 79 municipal departments responsible for geodetic and real property affairs, real estate cadastre, and land cadastre.

²⁷ <https://www.rak.ba/>

²⁸ <http://www.fgu.com.ba/>

4.1.3 Republic administration for geodetic and property affairs²⁹

The Republic Administration for Geodetic and Property-Legal Affairs, as an independent republic administration, in addition to the seat of the Administration, also has 48 regional units and 16 regional offices as organizational units of the Administration located in all local self-government units on the territory of Republika Srpska. The competencies of the Republic Administration for Geodetic and Property Affairs are determined by the Law on Republic Administration ("Official Gazette of Republika Srpska", No. 115/18) and the Law on Survey and Cadastre of Republika Srpska "Official Gazette of Republika Srpska", No. 6/12, 110/16 and 62/18).

The role of the geodetic administrations of both entities (FBiH and RS) is vital for the implementation of quality mapping because they have digital bases and maps and thus serve as focal points for displaying all spatial data for the territory of the respective entity. They can also display on their geoportals all geolocated statistical data in the field of telecommunications provided by RAK, competent ministries of transport and connection entities or operators.

4.1.4 The Agency for Statistics of Bosnia and Herzegovina³⁰

The main goal of statistics in Bosnia and Herzegovina is to present the circumstances in the most objective way, disseminate the data to users in a neutral and transparent way, focus on the events important to decision-makers and respect citizens' rights to access the public information.

There are three statistical institutions in Bosnia and Herzegovina. In line with the Law on Statistics, the competent authority for the national level is the Agency for Statistics of Bosnia and Herzegovina (BHAS), and for the entity level Institute for Statistics of Federation of Bosnia and Herzegovina (FIS), and Institute for Statistics of Republika Srpska (RSIS). Central Bank of Bosnia and Herzegovina (CBBiH) is responsible for monetary statistics, the balance of payment and other financial statistics in Bosnia and Herzegovina.

²⁹ <https://www.rgurs.org/>

³⁰ <https://bhas.gov.ba/>

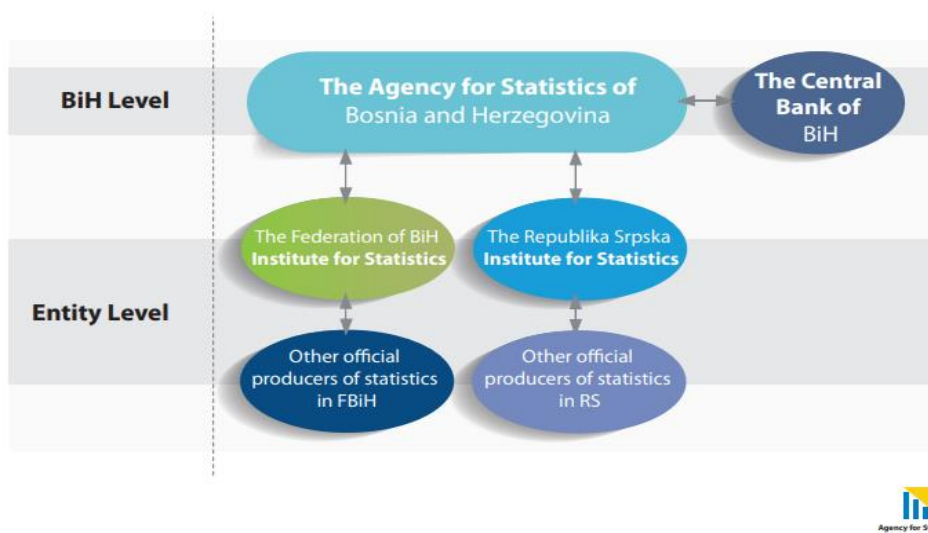


Figure 3 Statistical institutions in Bosnia and Herzegovina (image created by the Agency for Statistics of Bosnia and Herzegovina)

The agency presented as the state level of the statistical office in Bosnia and Herzegovina is primarily a link between the transmission of data controlled by the entities and the European institutions. Identifying priorities at the European level can thus provide additional focus and guidance in the preparation of such projects, as discussed in this report.

4.1.5 Federal institute of statistics³¹

The Federal Institute of Statistics is the important official source of information in the Federation of Bosnia and Herzegovina, which is independent in the choice of data sources, statistical methods and procedures, decisions related to content, form and timing of distribution and decisions related to data confidentiality. The data and information obtained through their research are recognized and have wide use and application. The Federal Institute of Statistics is an independent administrative organization that performs its tasks in accordance with the Law on Statistics in the Federation of Bosnia and Herzegovina (Official Gazette of FBiH No. 63/03 and 9/09) and conducts regular statistical surveys based on the multi-year Statistical Survey Program of interest to the Federation of Bosnia and Herzegovina and the annual Plan for conducting statistical surveys of interest to the Federation of Bosnia and Herzegovina.

4.1.6 The Republika Srpska Institute of Statistics³²

The Republika Srpska Institute of Statistics is a republic administrative organisation of Republika Srpska, within the Ministry of Finances, whose main task is to produce official statistical data for all categories of users, from the Government and other bodies, business systems, institutions of science, to the general public and individuals. Institute of Statistics is financed by Republika Srpska Budget. The competent authority for statistics in Republika Srpska is the Republika Srpska Institute of Statistics (Article 4 of the Law on Statistics of

³¹ <http://fzs.ba/>

³² <https://www.rzs.rs.ba/>

Republika Srpska). Within the scope of their activities, the production of statistics in Republika Srpska is also organised and carried out by other authorised producers of statistics following the Law on Statistics of Republika Srpska and the Programme of Statistical Survey of Republika Srpska.

The Institutes of Statistics of both entities play an important role in pairing data with location infrastructure data, as they are the owners of data on settlement boundaries - they have digital coordinates of the borders of settlements, municipalities and entities, as well as unique codes of all settlements in Bosnia and Herzegovina. Giving consent to RAK for the use of this data would enable a geolocated presentation of all collected data on telecommunications at the level of the borders of Bosnia and Herzegovina, entities, municipalities and settlements. Vice versa, statistical agencies can display on their websites geolocated statistics in the field of telecommunications provided by RAK.

4.1.7 Ministry of Communications and Transport of Bosnia and Herzegovina³³

The Ministry of Communications also conduct activities regarding postal services, radio, TV, broadcasting and informatisation as part of its competences. It carries out activities in relation to expert analyses and other materials, as a basis for improvement of the policy of the communications and informatization sector and cooperation with competent Entity ministries and Brčko District of B&H, especially with the Regulatory Agency for Telecommunications. Communications Unit within the Ministry prepares laws and by-laws in the area of telecommunications and information and monitors their implementation, cooperates with other bodies in preparation of development plans and initiates, at the state level.

The role of the Ministry (in relation to the current division of competencies in the country) is mainly in the preparation of normative, legislative bases - both for the implementation of mapping and for the regulation of the competencies of operational bodies. In doing so, this report has in mind primarily the state regulatory agency. At the same time, it could be the right address for dealing with communication problems arising from the division of competences between individual institutions and the entities themselves (it can assist them with the adoption of certain regulations within the competence of the entities).

The division of responsibilities between levels of government in the field of state aid is still unclear, but in general, all levels of ministries are important because they can implement resource allocation policies for underserved areas; in this context accurate broadband mapping is crucial for efficient allocation of state funds.

4.1.8 Federal Ministry of Transport and Communications³⁴

Federal Ministry of Transport and Communications executes the administrative, professional and other tasks as set out by the laws falling under competence of the Federation in areas of transport and communications. In detail, these areas are: transport and public roads, rail, air,

³³ <http://www.mkt.gov.ba/>

³⁴ <http://fmpik.gov.ba/bh/>

maritime, river, lake transport, pipeline transport, the safety of roads, railway, air, maritime, river and lake transport, pipelines transport, flight control, telecommunications and posts, except for establishment and functioning of the joint and international communication devices. The Ministry also covers inspection and supervision in the same areas.

This also means the entity's Ministry (as the mirrored Ministry in Republika Srpska) maintain the base of the entity's road network (markings, directions, length), collect certain data on telecommunications services and infrastructure in the entity. They maintain a network of fixed measuring stations for measuring the density of road traffic, which enables RAK to measure the availability and quality of mobile services on roads, or fixed points on roads paired with the frequency of traffic at those points. They have entity telecommunications inspectors and can help verify the accuracy of operator data.

4.1.9 Ministry of Transport and Communications, Government of Republic of Srpska

Ministry of transport and communication is an administrative body of Republic of Srpska, whose duties and responsibilities are established in the law on Ministries. The following are under the jurisdiction of the Ministry of transport and communication: road traffic and public roads; railway traffic and safety of the railway traffic; air traffic; inland waterways; safety of inland waterways; reloading services; communication system; radio communications; post, telegraph and telephone traffic; telecommunication infrastructure; coordination and other tasks.

4.1.10 Main operators of electronic communications networks and services

During the project, there was a common meeting with the three biggest operators of electronic communications and services in Bosnia and Herzegovina. The Slovenian broadband mapping experience was presented to HT Eronet, BH Telecom, Telemach and Mtel. Operators are an essential partner when it comes to performing mapping. After all, it is the telco operators who own most of the data, the processing and mapping of which are the aim of this report.

That said, the operators keep their own (GIS) data on their network, capacities and users and they are obliged to submit certain data to the entity geodetic administrations (according to the entity laws on spatial data infrastructure, they belong to the category of "subjects"). Through the submission of data via structured forms set by RAK, they provide insight into their capacities, networks, services, geographical distribution of users, received complaints by defined areas, intentions of investments in certain areas, investments in progress.

The overall picture of the situation with operators is quite diverse, as all operators still have problems with the proper recordings of obscure databases of old infrastructures, relics from the previous country. Records can be in paper form or there are no such records (missing inventories of cable lines, etc.). At the same time, they strive with modern approaches to geo-mapping of facilities and services, especially new technologies (optics), so they also develop GIS platforms for better processing of their own data.

Operators must be recognised as crucial partners when defining the exchange format and to establish a connection to serve as a platform for providing data to public authority. Mapping of the broadband infrastructure benefits a variety of stakeholders including telco operators as the owners of electronic networks infrastructure and operators of electronic communications services that need large-scale independent measurements to assess network performance.

4.1.11 Competent municipal administration bodies

The State of Bosnia and Herzegovina is virtually irrelevant regarding the functioning of regional and municipal government within the two entities. Each entity so far developed its own policy toward municipalities, their legal base and their financing in general.

Municipalities and communal service enterprises in Bosnia and Herzegovina are responsible for providing most local infrastructure. Although there is a discussion of utility concessions to attract equity capital and widespread interest in the idea of municipal borrowing to attract debt capital, there are no clear state or entity policies as to if or how private investment should be identified to help fund local infrastructure. There also is no clear and common understanding of how or where municipalities will get funds for infrastructure investment. In this context, some of the tasks to municipalities are identified, according to the draft local government law:

- to regulate and ensure the performance of public utilities;
 - to adopt a town construction land arrangement program;
 - to build, maintain and supervise the use of local roads, streets and other public facilities;
- etc.³⁵

For these purposes, legal basis for obtaining municipal infrastructure data have been established at the level of individual municipalities. This level in the FBiH is also the one that currently has the largest share of data; in practice, this means that municipal administrations manage the cadastres themselves. They keep cadastral data (land plots with borders, marked objects, underground and above-ground communal installations: pipelines, gas pipelines, cables). They are in charge of creating a geolocated address book for the municipal level. According to the regulator, about 90% of all data is still in paper, not digital forms. In addition, there is no common model in data acquisition and processing, which makes it extremely difficult to use at the national level.

Due to the above, municipal structures can be recognised to have an impact on the market regulation, especially in establishing mapping. In addition, municipalities are also the controller of data on the geolocated address book, which is one of the key databases in the pairing of data for the purposes of geo-mapping, so they must be involved in the establishment of the system. Through the entity geoportals, they can and should provide the authorized state institution (RAK) with an insight into the available physical infrastructure in a certain area.

³⁵ Local Government in Bosnia and Herzegovina, Charles Jokay

To sum up, each stakeholder (categorized into five groups, namely, Policy Makers, National Regulatory Authority, Data Authorities, Local Administrations, Data Providers) have different roles from legal and practical points of view in building broadband mapping system. The graph below shows how each group is positioned from these two major perspectives.

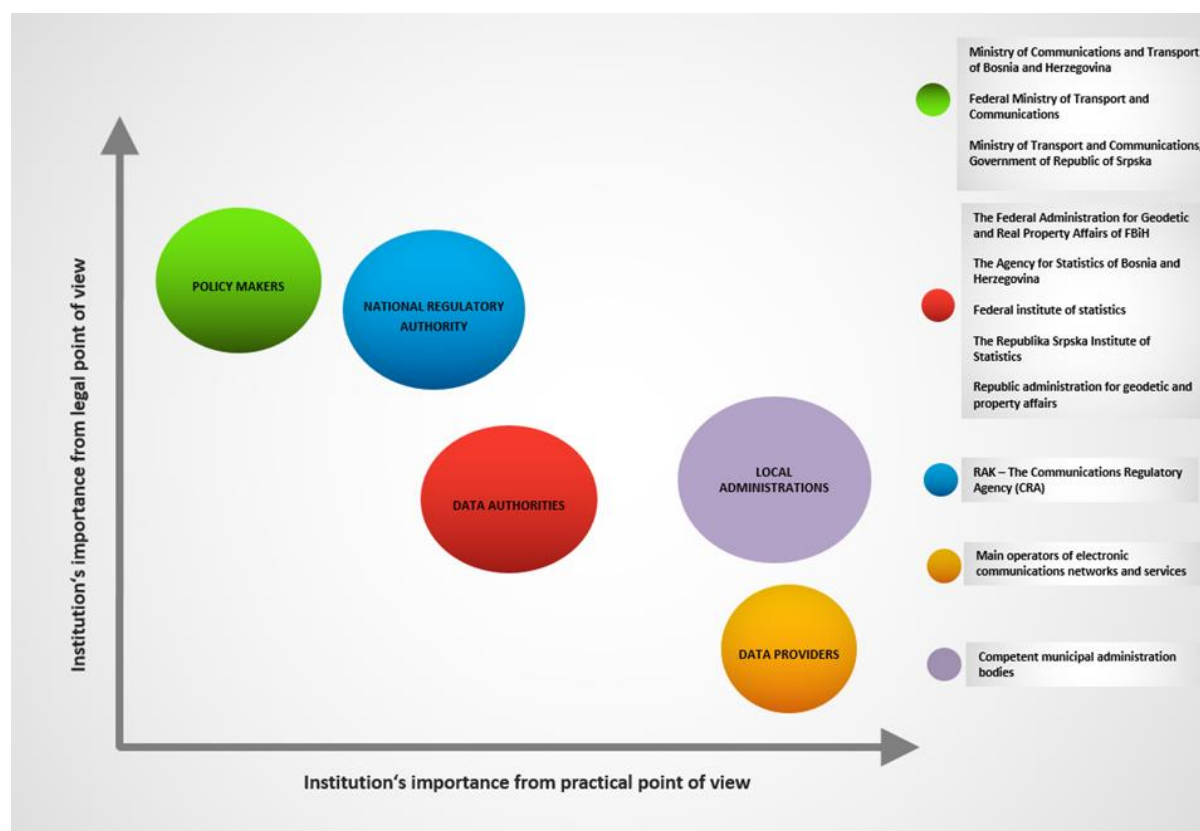


Figure 4 Importance of institutions from legal and practical points of view

4.2 Legal environment

The legal framework in Bosnia and Herzegovina is quite complex and challenging due to the combination of different government systems. In addition to the State, the two main entities have their own legal systems. In addition, the Brčko District has a separate legal framework. Only a small number of laws are adopted at the State level. As the entities have wide legislative competences, each of them can adopt quite different laws. The inconsistent and unclearly defined hierarchy of law norms stretches further to the canton level and municipality level. In the judicial sector, this results in two separate legal systems and there is limited coordination at the national level.

With the stimulus of the Office of the High Representative (OHR), the entities started enacting the so-called "mirror laws", i.e., laws being identical but enacted separately by the Parliaments in each entity. However, one of the main legal challenges facing the country, also in the context of making this report, is creating a uniform legal environment, and the prospects for Bosnia and Herzegovina depend largely on the implementation of practical legal reforms and integration both internally and on a supranational level.

The regulatory conditions for electronic communications (including broadband) are still based on a law dated 2003 - Law on Communications of Bosnia and Herzegovina³⁶ (Communications Law). The regulatory agency has used some of the more up to date principles in the EU legal and regulatory framework, including carrying out analyses of relevant markets and defining regulatory steps to improve competitive conditions. However, the EBRD survey respondents have stated that the required regulatory decisions have not been implemented for the benefit of market players wishing to launch new competitive services into electronic communications markets, including broadband. In particular, the regulatory steps used in the EU for promoting broadband investments are not present in Bosnia and Herzegovina. The institutional framework can be perceived as not ensuring adequate political independence or adequate financial and operational independence of the regulator, which undermines certainty for the sector and raises concerns over its efficiency.

Communications Law gives legal bases to RAK to request business data, network data and traffic data from telecom operators³⁷. Rule 66/2012 on the conduct of activity of public electronic communications network operator³⁸ further specifies, that (upon the agency's request) the operator must submit all information related to the performance of its activities, information about its operations and other applicable information required for the Agency to perform its regulatory competencies.

While the Agency is authorized (in accordance with Article 61 paragraph (2) and Article 99 of the Law on Administration³⁹) to issue appropriate instructions, guidelines and orders (which could be used to specify the types of data), it seems that the basic legal bases are already properly laid down. Nevertheless, the report raises the question of whether the legal basis presented is sufficient.

The long-term acquisition of all the necessary data for the regulators to implement an appropriate mapping environment requires a range of data (presented later in the report) that goes beyond the current regulatory framework to include other collaborating entities (e.g., Cadaster), or non-telecom operators (e.g., utility companies that may be willing to share their existing infrastructure in exchange of a fee). In any case, the presented legal bases do not cover entities that are not registered as telecom operators.

Bosnia and Herzegovina accepted the recommendation of the EU regarding application of INSPIRE Directive rules. Both entities are at the time of the report working on adopting amendments and new laws necessary for implementations of National Spatial Data Infrastructure, but each separately. In Republika Srpska, the Republic Geodetic Authority is the coordinator of NSDI implementation i.e., Infrastructure of Geospatial Data of Republika Srpska (IGDRS). In Federation of Bosnia and Herzegovina, the improvement in the area is expected through the new Law on Spatial Data Infrastructure of Federation of Bosnia and

³⁶ Official Gazette of BiH, No. 31/03, 75/06, 32/10 and 98/12

³⁷ Article 7 para. 3. c)

³⁸ Official Gazette of BiH, No.: 85/2012

³⁹ Official Gazette of BiH, No. 32/02 and 102/09

Herzegovina (Zakon o infrastrukturi prostornih podataka u FBiH)⁴⁰, which came into force in July 2021.

As defined in Article 5, the entities of spatial data infrastructure in FBiH are federal administration bodies and organizations (i), cantonal administration bodies and organizations (ii), local self-government bodies (iii), public companies (iv), legal entities (v) entrusted with spatial data management and legal entities using data and services covered by FBiH IPP. They provide public service services on the basis of these spatial data, and their competence includes the establishment or maintenance of spatial data. They are also obliged to participate in the establishment, maintenance and development of such data in FBiH.

Given the above-quoted definition, it is surprising that the national regulatory authority is not considered as a direct entity, which of course increases the authority's difficulties. In the following provisions, the Law provides for ways to include additional bodies among IPP entities, but according to the report, this procedure is rather formalized. It should be noted again that this would be the basis only for access to data in the FBiH area, and not in other entities. The above once again points to the additional need for better institutionalization of the right to obtain and process geospatial data even with the regulator itself.

As already mentioned in the previous chapter, municipalities have a legal basis for collecting all cadastral data in the Law on Cadastre of Communal Devices ("Zakon o katastru komunalnih uređaja"), which dates back to the times of the SFRJ⁴¹. The cadastre of communal devices is prepared and maintained by the competent municipal administrative body (Art. 6), and all others access this data through that body (or the FBiH Geoportal, if digitized).

As described above, Bosnia and Herzegovina has faced several legal challenges in developing a nationwide broadband mapping system. Evidence shows that the lack of a common legal framework is one of the main barriers to achieving effective collaboration among the interested parties. Despite the efforts in adopting the relevant EU regulatory framework and recommendations, insufficient legal basis still exists and required regulatory decisions have not yet been implemented in Bosnia and Herzegovina. Finally, Bosnia and Herzegovina needs to institutionalize the right to obtain and process geospatial data and further discuss to include other relevant entities within the regulatory framework to better shape the environment for broadband mapping.

⁴⁰ Official Gazette of FBiH No. 55/21

⁴¹ Official Gazette of SRBiH, No. 21/77, 6 / 88, 36/90, 4/93, 13/97

5. Proposal and recommendations for enabling environment for broadband mapping in Bosnia and Herzegovina

5.1 Proposals for strengthening the enabling environment

5.1.1 General proposals

Primarily, it is necessary to establish a positive climate that will enable the national (regulatory) authority to obtain, exchange and (re) use data for the needs of the telecommunications infrastructure records system.

It is vital to increase the awareness of stakeholders in Bosnia and Herzegovina that the institutionalization of geo-mapping in the country is necessary from several aspects.

The prospect of EU membership is a strong impetus for the continuation of already initiated reforms in Bosnia and Herzegovina and a driver of the process that should enable the creation of an economic, legal, organizational and social structure capable of operating in accordance with EU rules. With the aim of accelerating the process of Bosnia and Herzegovina's inclusion in European integration flows, an active role of all segments of society is necessary.

The obligation that brings the mandatory implementation of the BCRD is among the important legal obligations that await Bosnia and Herzegovina in the years of accession to the European Union. In the coming years, Bosnia and Herzegovina will in any case have to establish a transparent and accessible system of recorded telecommunications infrastructure.

Awareness is important not only from a legislative point of view but also from a simple development point of view. As a relatively unattractive country for investment, Bosnia and Herzegovina should offer additional incentives to the sector also in the form of available information, on the basis of which it is easier for the investor to decide to invest in a specific environment.

One of the conclusions of the report is that such database is urgently needed by the state itself for further development. In this area, the report has in mind the locations and regions that will remain unattractive to investors - so the future focus will be state aid in the areas of white spots. These areas will not be able to be correctly identified by the state without an appropriate mapping system and a support from the regulators in this area. It will be even less able to evaluate them (financially and developmentally) and position them correctly at the national level, which means inevitable additional costs and time lags.

Established trust between stakeholders in various sectors is a necessary precondition for establishing communication and, in the alternative, voluntary commitments. For example, the involvement of operators in the country's thinking on the deployment of networks in under-supplied areas is crucial. Taking into account the needs of operators in this area would significantly facilitate the development of the obligation itself, if operators would recognize their own advantages in developing a mapping project in such an approach. At the same time, however, good practices and experiences that have already been demonstrated by operators could be used.

Establish a unified database for broadband networks at the national level with a dedicated competent authority (a future "Single Information Point").

Bosnia and Herzegovina does not have a centralized broadband database, which includes information on existing broadband infrastructure in one place, and therefore bottlenecks are created during the collection, use and reuse of such data (on governmental and private sector level). Broadband mapping should for future reasons be in line with the methodology used in the EU. Once the process is complete with key stakeholders, it is logical to create a single reference platform with complete broadband data. Defining the competent authority that manages such a database would also mean defining the roles and responsibilities of the competent authority, but also the roles and responsibilities of other engaged participants. According to the drafters of the report, a national regulatory authority is appropriate for such a task.

Strengthen the regulatory body for the quality use of mapping data.

It is necessary to train the national regulatory authority for optimal knowledge of the type, formats and use of possible databases, so that it will be able to identify the quality and usability of the existing and future data (or to design new ones that prove necessary). It is reasonable to expect that the regulatory body needs to be strengthened a) in terms of staff with experts in the field of geo-mapping and spatial legislation, and b) technically with tools for the use of such databases, and finally, c) with a predefined financial budget allocated to RAK that would sustain the project all along its operations and next phases.

The long-term proposed solution would be to complement the regulatory environment in such a way, that the national regulatory authority is entitled and competent to obtain data directly from the owners or operators of the telecommunications infrastructure.

Eligibility is needed specifically for the purpose of geolocating such infrastructure and must therefore be specified in more detail (as opposed to the general rules on the submission of information by operators, already adopted in national law). This would also regulate the legal basis for obtaining information on infrastructure not owned by registered telecommunications operators (e.g., utilities, local communities).

One of the possible paths would be to establish a special rulebook on the basis of which the obligation to submit data would be established for operators through specially structured forms from which insight will be obtained into data on geographical availability of services (address level, settlement, municipality, entity), geographical presence of operators (areas of network and service presence) and their capacities (lines, nodes, main hubs, radio locations, company headquarters, points of sale), geographical distribution of users, quality of services, traffic exchange between operators, geographical distribution of revenues, user complaints, violations, intentions investments in certain areas, investments in progress and more. Part of this data could be collected by the NRA independently, through its monitoring, inspection supervision and online application for measuring the quality of services.

5.1.2 Proposals for cooperation with relevant institutions

Establish communication protocols or memorandums (formal or informal agreements) with data acquisition and exchange authorities.

The currently identified needs of the NRA for performing tasks in this area are the (re)use of digital maps, digital backgrounds (borders of the state, entities, settlements and parts of settlements if available). For effective data acquisition, the NRA should be granted the status

of the subject of the application and then, in accordance with the Inspire Directive, define which data it needs in a pre-prescribed format. Institutions should recognise and extend friendly relations on the basis of equality and mutual benefit. Recognizing the importance that electronic communications have been in the development of the social and economic welfare of all institutions. Convinced of the need for and desirability of greater cooperation between the institutions, they shall agree to cooperate with the purpose of exchange of information and experiences.

5.1.3 Proposals for data format specifications

Bosnia and Herzegovina should set out the rules and precisely define exchange format of data in order to get the relevant and unified information from relevant owners of electronic communications infrastructure.

Although RAK has already established a basic legal background for electronic communications providers in collecting data in its existing electronic communications law, it would be necessary to define and set out exact rules on the management and the content of data on electronic communications infrastructure, especially regarding network termination points and electronic communications lines. To support such kinds of rules, RAK would need to provide an exchange format and strictly define format specifications. Data sources and frequency of data collections should also be envisaged.

Several spatial resolutions can be used for data collection, for example, geocoded information/geographical coordinates (points or addresses), grid-level data, local administrative unit level data, and NUTS level data. A high resolution is necessary for most of the regulatory and policy functions that the survey of broadband reach and performance is intended to provide information for. For fixed networks, the level of resolution should be the address. For mobile networks, the level of resolution should be a 100m x 100m or smaller grid (or equivalent polygon).

GIS is a system of hardware, software and procedures to facilitate the management, manipulation, analysis, modelling, representation and display of georeferenced data to solve complex problems regarding planning and management of resources. The functions of GIS include: data entry, data display, data management, information retrieval and analysis. The usage of GIS is an important tool to GIS facilitates the development of the usage of geospatial data of the reach of electronic communications networks.

To set out such rules and specifications of required data, the “BEREC Guidelines to assist NRAs on the consistent application of Geographical surveys of network deployments”⁴² are regarded as a model to follow. This document addresses epistemological definitions and technical definitions of the parameters to be used for both fixed and mobile spatial data to indications regarding data resolution and confidentiality issues. Finally, as a guidance on conducting geographical surveys regarding electronic communication, the BEREC guidelines will also help Bosnia and Herzegovina to have harmonized and standardized rules and definitions, which will lead to having a consistent broadband mapping system with other EU countries.

42 BEREC Guidelines on Geographical surveys of network deployments, BoR (20) 42, 05.03.2020.

5.1.4 Proposals for technical solution on broadband mapping

Ensure that all available information on existing (and planned) infrastructure includes georeferenced information. Bosnia and Herzegovina should consider establishing an obligation for the network operators and public sector bodies to provide georeferenced information regarding existing physical infrastructure and planned civil works in specific pre-defined formats

The main reason for this recommendation is the better utilization of the existing physical infrastructure, the acceleration of network roll-out and the lowering of costs for investors. It will support the rational use of space, a minimization of construction of outside infrastructure corridors and an expected reduction of pressures on green fields.

The provision of georeferenced information (e.g., in the form of interactive web map, digital models or equivalent) enables browsing or accessing georeferenced data of the existing physical infrastructure and planned civil works to relevant parties such as operators, public administration, local government, NRA, other business, end-users and other entities.

The availability of georeferenced data contributes to an increased level of shared use of existing capacities and developments of electronic communications networks. When planning the installation of their networks, electronic communication operators would gain faster and simplified access to a larger amount of information about existing physical infrastructure, making it easier to roll out their networks. It grants operators easier access to all available relevant physical infrastructure information and therefore easier cost-effective planning of rollout in a target geographical area.

The following stakeholders responsible for the implementation of this recommendation would be the state (NRA) and network operators and public bodies, as providers of the georeferenced information.

When such information is not available by the network operators and public sector bodies, the state should provide for the necessary tools to transform existing physical infrastructure information into a georeferenced format.

Where georeferenced information on the existing physical infrastructure is not yet available, Bosnia and Herzegovina should consider establishing a transitional period to digitalize and make georeferenced all relevant information by the network operators and public sector bodies.

In the process of data provision of the georeferenced information, several steps would be advisable:

- all attributes of the information to be provided should be defined unambiguously;
- data should be verified by the data holder;
- the network operators and public sector bodies should be responsible for the accuracy update and relevance of this data;
- data should be sufficiently detailed (e.g., taking into account standards from the Directive 2007/2/EC of 14 March 2007 (INSPIRE Directive), a general framework for a spatial data infrastructure);
- the data should be easy to use, with no additional software needed (e.g., web-browser

based), or compatible with widely used software;

- all collected data should be available on equal terms, either to the public or to users with granted rights;
- a suitable transitional period for the network operators and public sector bodies (e.g., five years) to digitalize could be foreseen.

5.2 Objective-setting and roadmap

The objective setting would definitely help the broadband mapping in Bosnia and Herzegovina to progress and plan for the future.

At this moment, it is hard to define a realistic timescale but a lot of initial work was already done during drafting this report. While preparing it, the project team held many initial meetings with relevant stakeholders in order to discuss and start initial talking.

A lot of positive feedback was received and active support to the project was promised on all levels. The first steps presented on the bottom of the roadmap picture on the right side has already started.

For the continuation of this process, the most important is to have intensive communication between all identified stakeholders, which is essential to reach the goal of implementation at the user levels.

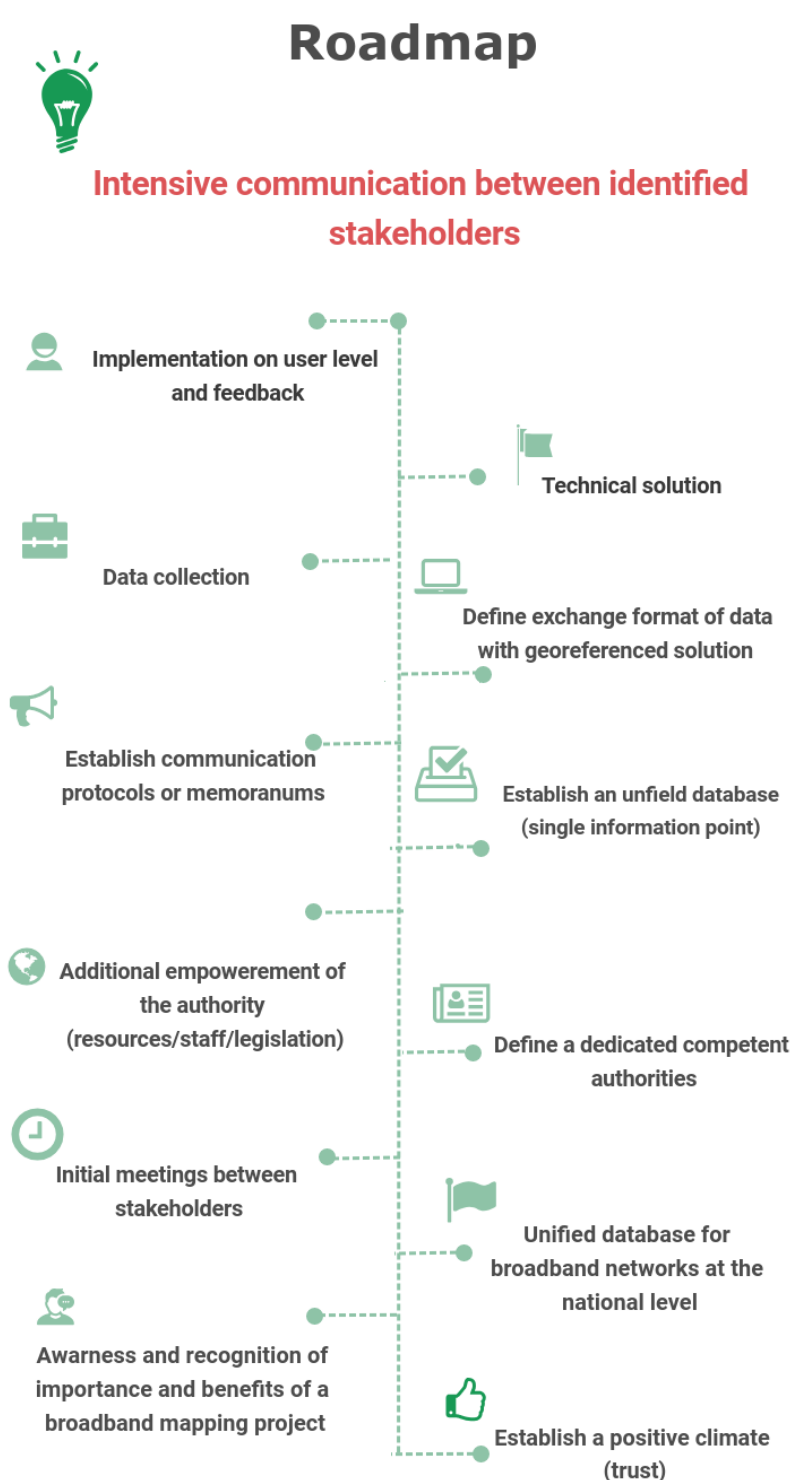


Figure 5 Roadmap on Intensive communication between identified stakeholders

6. Conclusion

The conclusions of the report are connected with the peculiar institutional setting in the country. More specifically, they are based on the information that was largely obtained in the area and institutions of FBiH. Although the findings are based on the FBiH model, in fact, there are no reservations that they could not be applied to the whole country.

The precondition for the establishment of a unified, functioning state infrastructure mapping system is a unification between the entities. This is also a prerequisite for effective service mapping projects aimed at maximising the reach of telecom infrastructure in the country. Therefore, even a basic recommendation can only be to improve and strengthen cooperation between the entities.

At this stage, given the described situation in the country and the relations both at the level of stakeholders and at the level of the entities themselves, it is certainly premature to talk about the preparation of technical specifications in the form of a fully developed data format. However, following the above recommendations, the next phase would be significantly facilitated, where a clean project design would be possible and undertaken by the Communications Regulatory Agency in coordination with all other stakeholders.

Overall, RAK has raised two main issues preventing progress in the field. The first one pertains to the jurisdictional system that is fragmented and prevents collaboration across sectors, for example in the matter of permit granting and use of spatial data. The second issue pertains to the lack of regulations setting the obligation for operators to provide the agency with data on infrastructure and services up to the address point. This scenario makes it difficult in turn to make efficient use of public funding and have a data- or knowledge-based approach to public infrastructure sharing.

In case proposals and recommendations for enabling environment for broadband mapping in Bosnia and Herzegovina would receive institutional support, a clear project design and all technical specifications can be undertaken by RAK and other stakeholders.