REPUBLIC OF CROATIA

MINISTRY OF MARITIME AFFAIRS, TRANSPORT AND INFRASTRUCTURE

National Programme for the Development of Broadband Backhaul Infrastructure in Areas Lacking Sufficient Commercial Interest for Investments, as a Prerequisite for the Development of Next Generation Access Networks (NGA)

2nd version following the Public Consultation conducted in 2014, Zagreb, January 2015

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Executive Summary

This document defines a *National Programme for the Development of Broadband Backhaul Infrastructure in Areas Lacking Sufficient Commercial Interest for Investments, as a Prerequisite for the Development of Next Generation Access Networks (NGA)*. This programme is aimed at building the national Next Generation Network (hereinafter NGN) broadband backhaul infrastructure and connecting the targeted end-users within a group of public administration bodies to the Next Generation Access (hereinafter NGA) broadband infrastructure supporting the symmetric access speeds above 100 Mbit/s (hereinafter *ultra-fast access*).

The Programme formally includes two project units: the project unit PU-A comprising the construction of the NGN backhaul infrastructure and the project unit PU-B comprising the connection of end-users within public administration bodies to the NGA ultra-fast infrastructure. The project unit PU-A includes State aid, and therefore the State aid approval confirming the compliance of the complete Programme with State aid rules will be obtained through the pre-notification and notification procedures in the relevant European Commission bodies.

The targeted areas for fostering the construction of NGN backhaul infrastructure by this Programme comprise mostly areas where currently the only available backhaul network is the network owned by an incumbent, i.e. former monopolistic operator, "Hrvatske telekomunikacije d.d." (*Croatian Telecom Inc.*; hereinafter HT). The intervention by this Programme is necessary because the existing capacities and technological characteristics of the HT's backhaul network do not allow neither the development of NGA networks nor the competitive supply of NGA services based on physical access within the NGA networks in suburban and rural areas of Croatia. Such a situation cannot have an incentive effect on the uniform development of NGA broadband at national level, and it is the reason why Croatia, according to all the relevant NGA development indicators, is among the worst countries in the EU.

From a perspective of anticipated infrastructural solutions and technologies, the backhaul network construction within the Programme will be mostly based on implementing the passive fibre-optic infrastructure. Only a small part of the backhaul infrastructure, in order to cover the remote mountainous areas and small islands, will be implemented using the fixed wireless point-to-point links.

The Programme will be carried out implementing a *public design, build and operate* (hereinafter *public DBO*) investment model. A Competent Authority for the operational implementation of the Programme (hereinafter CAOI) will be the public company "Odašiljači i veze d.o.o." (*Transmitters and Communications Ltd.;* hereinafter OiV). The OiV will be providing the wholesale services of leasing the backhaul infrastructure built within the project unit PU-A to all operators on the market under equal wholesale conditions in accordance with the principle of an open network.

It is planned to implement this Programme in two phases, where the implementation periods for the first and second phase are 2015-2018 and 2017-2022, respectively. The Programme anticipates to encompass 187 settlements with more than 2,000 inhabitants during the first phase (23.3% of the Croatian population), as well as 449 smaller settlements with more than 1,000 inhabitants and all *central* town and municipal settlements in which there are public users, during the second phase (10.9% of the Croatian population).

1 Introduction

This document defines a programme for building the national Next Generation Network (NGN) broadband backhaul infrastructure and connecting the targeted end-users within a group of public administration bodies to the Next Generation Access (NGA) broadband infrastructure supporting the symmetric access speeds above 100 Mbit/s. The full name of the programme is *National Programme for the Development of Broadband Backhaul Infrastructure in Areas Lacking Sufficient Commercial Interest for Investments, as a Prerequisite for the Development of next Generation Access Networks (NGA)*. For simplicity reasons, this programme will be hereinafter referenced by the abbreviation "NP-BBI" (emanating from *National Programme for Broadband Backhaul Infrastructure*) or only by the abbreviated name "Programme".

This document is the second version of the Programme, updated after completing the first public consultation on the Programme. Since the Programme part comprising the implementation of the backhaul infrastructure is considered as State aid, upon amending the first version of document in line with the relevant results of the first public consultation, this second version of the Programme is prepared for submitting to the *Directorate-General for Competition* (hereinafter DG COMP) of the European Commission for the preliminary verification (i.e. *pre-notification*) of the Programme, i.e. to determine whether the basic features of the Programme comply with the State aid rules of the EU. This will be followed by implementing a formal procedure for assessing the conformity of the Programme with the State aid rules (i.e. *notification*), in accordance with the applicable legislation in the Republic of Croatia and the relevant regulations and guidelines of the European Commission.

The funds required for implementing this Programme will be ensured mostly within the *European Regional Development Fund* (hereinafter ERDF) during the financial period 2014-2020 within the Priority Axis *Use of Information and Communication Technologies* of the Operational Programme "Competitiveness and Cohesion" (hereinafter OPCC). In this sense, the planned Programme implementation period coincides with the above-mentioned financial period of the European Structural and Investment funds (hereinafter ESI or *ESI funds*).

1.1 Objectives of the Programme

The NP-BBI is aimed at achieving two main objectives:

a. developing the national NGN broadband backhaul, as a network segment interconnecting NGA networks and national core networks;
b. ensuring the availability of ultra-fast NGA broadband for the purposes of public administration bodies (State administration bodies and their branch offices; educational, health and cultural institutions, etc.; hereinafter denoted also as *public users*) in areas where the ultra-fast NGA broadband is not commercially available and which coincide with the areas of the backhaul network roll-out within

the above-mentioned first objective of the Programme; the mentioned ultra-fast broadband access for the purposes of public administration bodies implies the possibility of realising the *symmetric* access with speeds above 100 Mbit/s in *both directions*, towards the user (*download*) and from the user (*upload*)).

The first objective of the NP-BBI is complementary to the objective of a *National framework programme for the development of broadband infrastructure in areas lacking sufficient commercial interest for investments* (hereinafter Framework Programme; a State aid programme by its form). The objective of the Framework Programme is to ensure the NGA broadband for all end-users in Croatia through promotion of NGA network roll-outs. The implementation of the NP-BBI is a prerequisite for the full implementation of the Framework Programme in all areas of Croatia without an adequate NGN backhaul.

While, in a formal legal sense, the accomplishment of the first Programme objective includes State aid, the accomplishment of the second objective does not, because it realises the self-supply/self-provision of ultra-fast broadband connections as broadband access infrastructure for the public administration bodies that does not perform economic activities. However, for the reasons of legal certainty, the compliance of the first objective with the State aid rules as well as the absence of State aid for the second objective will be jointly verified through the common pre-notification and notification procedures by the relevant bodies of the European Commission. A more detailed explanation of the formal and legal aspects of the NP-BBI in terms of State aid is presented in Chapter 1.5.

Concerning infrastructural, technological and implementation terms, the NP-BBI will be realised by constructing the unique electronic communications infrastructure supporting the accomplishment of both Programme objectives. Only for formal reasons, the preparation and implementation of the NP-BBI is divided into two project units "A" and "B", as follows:

A. Project unit A (hereinafter PU-A): national NGN broadband backhaul;
B. Project unit B (hereinafter PU-B): connecting of public administration bodies to the NGA broadband infrastructure.

This formal separation into two project units will be adequately identified through the document where it is necessary, given the need of compliance with the State aid rules. In all other cases, where it is not particularly indicated in the document, both project units will be treated jointly as a single entity.

1.2 Strategic starting points of the Programme

1.2.1 Digital Agenda for Europe

The *Digital Agenda for Europe* (hereinafter DAE) [1] is one of the seven strategic initiatives within the European umbrella strategy Europe 2020 [2]. The time frame for the DAE, as well as for the umbrella strategy Europe 2020, covers a ten-year period 2011–2020. The DAE thematically covers the comprehensive field of digital technologies, which also includes the broadband access, with broadband access infrastructure and broadband

services. The general objective of the DAE is the *achievement of sustainable economic and social benefits in a digital single market based on fast and ultra-fast internet access and interoperable applications.*

Considering the broadband infrastructure, the DAE lays down two key performance targets in terms of availability and utilisation of fast and ultra-fast broadband access by 2020:

DAE_c[1] achieving a general (i.e. for 100% of the EU population) broadband access coverage with a minimal speed of 30 Mbit/s (*fast access*);

DAE_c[2] at least 50% of European households are using broadband access with speeds above 100 Mbit/s (*ultra-fast access*).

In addition to these, the DAE specifies the objectives related to development and utilisation of broadband services and for whose achievement is necessary to ensure the availability of adequate broadband infrastructure:

DAE_c[3] objectives related to a digital single market - developing eCommerce, including cross-border eCommerce, as well as increasing the usage of eCommerce by small and medium enterprises (SME);

DAE_c[4] increasing the Internet usage among the population (75% by 2015), including also the reduction of the share of population that has never used the Internet (at 15% by 2015);

DAE_c[5] increasing the use of *eGovernment* (50% of the population are using these services by the end of 2015), including the cross-border use of such services.

Through the project unit PU-A, together with the complementary State aid programme for the access networks (Framework Programme), the NP-BBI promotes the realisation of both infrastructural targets related to the availability of NGA broadband, i.e. DAE_c[1] and DAE_c[2]. Furthermore, the assurance of availability of adequate broadband infrastructure creates the prerequisites for, and indirectly promotes the increase of, the usage of the Internet and related services and e-Commerce applications. Connecting the public administration bodies through the NP-BBI within the project unit PU-B ensures the infrastructural prerequisites for developing and providing e-Government services by State administration bodies, directly increasing also the usage of e-Government services by private and business users on the entire territory of Croatia (DAE_c[5]).

1.2.2 National Strategy for Broadband Development

The current *Strategy for Broadband Development in the Republic of Croatia* [3] (hereinafter *Broadband strategy*) that was adopted at the end of 2011, covers the period 2012-2015. The adoption procedure for the new broadband strategy anticipated for the period 2016-2020 is initiated. The new broadband strategy will be harmonised with DAE targets for the remaining period up to the year 2020.

The currently valid Broadband strategy specifies one main objective and three specific objectives arising from the main objective:

SŠP_c[1] main objective - creating the prerequisites for the accelerated development of infrastructure for broadband access to the Internet and services that require high-speed access, as the foundation that will enable further development of the information society and knowledge-based society, ensuring the availability of broadband access services under equal conditions on the entire territory of Croatia;

SŠP_c[2] specific objective - ensuring the effective market competition;

SŠP_c[3] specific objective - ensuring the availability of broadband access to the Internet;

SŠP_c[4] specific objective - stimulating the demand of broadband services and broadband access usage for citizens and economic operators.

The NP-BBI entirely follows the main objective and specific objectives of the Broadband strategy. By ensuring, within the project unit PU-A, the availability of NGN broadband backhaul network in all parts of Croatia, as a basic prerequisite for the development of NGA networks, the NP-BBI follows the main objective SŠP_c[1] and the specific objectives SŠP_c[2] and SŠP_c[3] of the Broadband strategy. By connecting, within the project unit PU-B, the public administration bodies via ultra-fast broadband connections, the NP-BBI supports the development and provision of eGovernment services, and stimulates the demand for broadband services, i.e. supports the specific objective SŠP_c[4] of the Broadband strategy.

1.2.3 Using ESI funds in Croatia in the period 2014-2020

The rules for a project co-financing from ESI funds in the period 2014-2020 are defined at the EU level by the relevant umbrella regulations and detailed in the relevant national programming documents, as well as laws and bylaws in Croatia. The co-financing funds for implementing the NP-BBI are ensured within the *European Regional Development Fund* (ERDF). The following umbrella regulations at the EU level are relevant:

- Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006 (usually called "CPR - *Common Provisions Regulation*") [4];
- Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific

provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006 [5].

In addition, the following national programming documents for ESI funds and law and bylaw acts are relevant for implementing the NP-BBI:

- Partnership Agreement for the European Structural and Investment funds in the EU Financial Period 2014-2020 [6]
- Operational Programme "Competitiveness and Cohesion" (OPCC) [7]
- Act on the Establishment of an Institutional Framework for the Implementation of European Structural and Investment Funds in the Republic of Croatia in the Financial Period 2014-2020 [8]
- Regulation on the Bodies of the Management and Control of the Implementation of the Operational Programme "Competitiveness and Cohesion" [9]
- Common national rules for the European Structural Funds and the structural funds in the Republic of Croatia during the financial period 2014-2020.

1.3 Legislative framework

1.3.1 Electronic communications

The Electronic Communications Act (hereinafter ECA) is an umbrella act regulating the electronic communications sector in Croatia [10]. Based on the ECA, the bylaws laying down detailed rules for the specific parts of the electronic communications sector have been adopted. The following bylaws are important for the NP-BBI:

- *Regulation on the criteria for the development of electronic communications infrastructure and other associated facilities* [11], laying down the rules for planning the electronic communications infrastructure in spatial (physical) planning procedures;
- *Ordinance on manner and conditions of access to and shared use of electronic communications infrastructure and other associated facilities* [12], laying down the modalities and rules for the access to, and sharing of, ducts, poles, antenna masts, as well as buildings and other associated facilities and equipment between multiple operators;
- *Ordinance on technical requirements for cable ducts* [13], laying down the technical conditions for planning, building and maintaining cable duct systems.

1.3.2 State aid

The rules for justification of State aid for particular cases or sectors are defined at the EU level and derived from Article 107, paragraphs 2 and 3 of the *Treaty on European Union* and the *Treaty on the Functioning of the European Union* (TFEU) - both contracts have been amended over a number of years, and currently are consolidated as a single document [14].

Article 108, paragraph 3 of the TFEU defines the obligation of notifying each State aid, planned to be granted in the Member States, to the European Commission in order to verify its conformity with the exceptions of the justifiability of State aid referred to in Article 107, paragraphs 2 and 3 of the TFEU (verification of conformity of State aid for broadband networks is carried out according to Article 107, paragraph 3 of the TFEU). Certain types of aid may be exempted from the obligation of notification to the European Commission, in accordance with Article 107, paragraph 4 of the TFEU, or regulations issued in accordance with Article 109 of the TFEU (for example, General Block Exemption Regulation - GBER [15]).

Rules and practice of verifying conformity of State aid for broadband networks in the European Commission are formalized through the *Guidelines for the application of State aid rules in relation to the rapid deployment of broadband* networks (hereinafter *Broadband Guidelines*) [16]. Additionally, the former practice of the European Commission regarding the approved programmes or projects for building broadband networks using State aid is presented through the individual decisions [17].

The framework for State aid in Croatia is defined by the State Aid Act (hereinafter SAA) [18]. The SAA stipulates that the Ministry of Finance is competent for the approval of individual State aid or State aid programmes. Each individual State aid or State aid programme must be notified to the Ministry of Finance, which forwards the notifications to the European Commission for further verification[1] if it is necessary and in accordance with the provisions of the GBER. In addition, each State aid must comply also with the guidelines on State aid policy in Croatia that are adopted for a three-year period. Currently applicable State aid guidelines for the period 2014-2016 [19] consider (in pertaining Chapter 4.3) also the State aid for the *development of broadband networks* as one of the primary objectives of State aid policy in the above-mentioned period. In that sense, this Programme is fully compliant with the guidelines on State aid policy in Croatia, as the Programme encourages *larger broadband network coverage, development of additional capacity and higher speeds, as well as broadband network convergence to the end-users*, as it is stated also in the guidelines.

1.3.3 Public procurement

All the procedures for the procurement of services, goods or works required for implementing the Programme will be in compliance with the valid Public Procurement Act (hereinafter PPA) [20], [21]. Implementation of transparent public procurement procedures in case of State aid is required by the rules of State aid conformity laid down in Article 78c) of the Broadband Guidelines.

Each public procurement with an estimated value exceeding EUR 200,000 in HRK counter-value, in accordance with the provisions of the PPA, will be published in the

[1] For the avoidance of doubt, according to the definitions of Article 2 of the SAA, the NP-BBI is considered as *individual* State aid, not as a State aid *programme*. In this respect, the fact that the NP-BBI is in general a *programme* for implementing the broadband backhaul infrastructure does not mean that the NP-BBI is also the *State aid programme* in accordance with the SAA definitions.

Electronic Public Procurement Classifieds of the Republic of Croatia (EPPC) [22] and Supplement to the Official Journal of the EU dedicated to European public procurement (TED - Tenders Electronic Daily) [23].

1.4 Linked programmes and projects at the national level

1.4.1 National Framework Programme

National framework programme for the development of broadband infrastructure in areas lacking sufficient commercial interest for investments (Framework Programme) [24] is a State aid programme aimed at promoting the roll-out of NGA broadband networks in the local self-government units (cities/towns and municipalities; hereinafter LSUs) comprising white and problematic grey areas in accordance with the rules of the Broadband Guidelines and definitions within the Framework Programme.

The first version of the Framework Programme was prepared during 2013, after which the public consultation on the Framework Programme was conducted. Taking into account comments and suggestions received during this public consultation, the Framework Programme was modified and submitted in the pre-notification procedure in the bodies of the European Commission in April 2014.

The Framework Programme and the NP-BBI within the project unit PU-A are complementary State aid programmes for the access networks and backhaul networks, respectively. The coordinated implementation of both programmes creates a prerequisite for achieving the national objectives and strategic objectives of the DAE in the electronic communications and broadband access sectors. In the absence of appropriate NGN backhaul infrastructure by which is possible to connect the NGA and core networks under acceptable market conditions, end-users would not be able to use fully, or could not use at all, the available capacity of their NGA broadband connections. Therefore, the independent implementation of the Framework Programme would not contribute to the full achievement of socio-economic benefits from the utilisation of NGA broadband services in local communities.

In view of the project unit PU-B, the complementarity of the Framework Programme and NP-BBI implementations is reflected in the fact that if adequate NGA infrastructure enabling ultra-fast broadband in both directions[2] for targeted public users will not be implemented within the Framework Programme, this infrastructure will be realised within the project unit PU-B of the NP-BBI. This will be the case mostly in small rural settlements covered by the second phase of the NP-BBI (see Chapter 5.1).

The Competent Authority for the Programme (CAP) will coordinate the implementations of the Framework Programme and the NP-BBI. The function of the CAP, as State aid granting authority, will perform the same public body for both the Framework

[2] Given the current development level of NGA technologies, it implies the implementation of the fibre-optic infrastructure to the targeted public users (FTTH).

Programme and the NP-BBI. It is anticipated that HAKOM will formally take the function of the CAP after the final approvals of the Framework Programme and the NP-BBI by the European Commission (see also Chapter 1.5.3).

1.4.2 e-Citizens

The Government of the Republic of Croatia initiated in 2013 a project entitled e-Citizens [25] following, among other things, the *eGovernment* initiative at the EU level. The basic objectives of the e-Citizens project are *access to public information and information about public services in one place, secure access to personal data and electronic communications of citizens and the public sector*.

A detailed overview of e-Government services in Croatia, together with the likely course of further development of these services, is given below.

Central Government portal

The Central Government portal is a constituent part of the e-Citizens project that will merge all the existing portals of the Government, the Parliament, ministries and other State administration bodies, and serve as a central portal for access to the information about public services, as well as the information and documents related to implementation of policies, all together in easily accessible formats.

Personal user mailbox

The personal user mailbox will enable every citizen of Croatia, in one place and in a safe and confidential manner, to receive, review, follow and manage all personal communication with the public sector or to be informed about important situations and events related to personal legal rights and obligations, as well as about the use of personal data in the public sector. On the other hand, the user mailbox will enable the public bodies, as providers of e-government services, to deliver, simply, automatically and reliably, official correspondence to its parties.

e-Health

e-Health refers to a group of services of e-government in the health sector. The majority of e-health services is currently based on mutual interaction between providers of health services (primarily health care surgeries, hospitals, laboratories, pharmacies), ultimately aimed at providing more efficient services to their patients. These are services of e-referrals, e-prescriptions, e-appointments, e-waiting lists and e-records. It is expected that the participation of patients in all interactions included in the provision of e-health services will increase over time (e.g. reviewing their own e-records, reviewing medical reports over the Internet etc.)

e-Education /e-Science

e-Education and e-Science are common names for all services in the education, higher education and science, which are provided with the assistance of information and

communication technology, where services may be accessed via broadband connections. Within the above-mentioned group of e-services in Croatia, the services of e-enrolment to colleges and universities, as well as to high schools (since 2013), have been developed and currently are operative. Furthermore, application platforms supporting distance learning have also been developed, and it is expected that these platforms will be more often used in practice, that is, that more contents will be available for distance learning. Furthermore, it is established a database of educational contents that may be accessed by all employees in the educational system and students (electronic databases of required reading - e-reading, books – e-library, educational films etc.). In addition to the above-mentioned contents and services aimed at all participants in the educational system, the informational systems for administrative support to higher education institutions (Information System of Higher Education Institutions - ISHEI) and e-registers for elementary (primary) schools and high (secondary) schools have also been developed or are being developed.

e-Justice

e-Justice involves a set of e-government services that are covered by the organization of, or are linked to, the justice system. e-Justice services are being continuously expanded and upgraded. A short list of services that are available in mid-2014 is given below:

- e-Excerpt – access to data from land registries;
- e-Notice Board – access to data from notice boards of municipal and commercial courts;
- e-Case - information about the status of court cases from the database of the Integrated Case Management System (e-File);
- e-Company - a service within the HITRO.HR set of services enabling faster company registration procedure using electronic submission of all the necessary forms and documents between public notary offices, commercial courts, and the Financial Agency (FINA).

e-Taxes

e-Taxes is a system of Tax Administration services enabling tax payers to register their taxes electronically (value-added tax, income tax, company profit tax) and access to their tax records.

e-Agriculture

e-Agriculture covers all e-government services related to the agricultural sector that have been available in the middle of 2014, as well as the services whose development and implementation are ongoing, and it is expected that they will be available in the targeted time period of this Programme:

- ARKOD - a system of electronic records of land parcels and their use, related to direct payments in agriculture;

- agronet - an electronic application intended for agricultural farms and other users in obtaining their right to direct payments in agriculture;
- MISA (Market Information System in Agriculture) - a system of collecting and processing of data on the agricultural and food product market;
- GISF (Geo-information System for Fisheries) - a system that enables collecting, processing and archiving of data from the fisheries sector and their distribution to the end-users.

Overall, it can be concluded that the above-mentioned e-government services represent a great potential for developing and increasing the broadband access demand. This is particularly evident in the fact that e-government services cover a wide range of end-users spatially dispersed in all local environments: citizens (private households), economic subjects (crafts and companies), educational institutions (kindergartens, elementary (primary) schools and high (secondary) schools, colleges and universities), as well as health institutions (primary health care surgeries, health care centres, hospitals, pharmacies). Development and further expansion of the e-Government scope increase the need for better and faster NGA broadband, both due to access to a larger number of multimedia contents and due to the realisation of multimedia links (e.g. for the purposes of distance learning and telemedicine), that is, the possibility of end-users to send more contents towards the providers of e-government services (*upstream* communication).

The implementation of the NP-BBI is also complementary to the implementation of the project e-Citizens, because it creates the infrastructural prerequisites for the realisation of fast and ultra-fast connections for a broad range of end-users:

- by building the NGN backhaul infrastructure (within the project unit PU-A) to be used by all operators serving the end-users within the access networks, thus ensuring the prerequisites for the supply of NGA broadband connections within a wide user segment of citizens as users of e-government services;
- by connecting the public administration bodies via ultra-fast broadband connections (within the project unit PU-B), as generators of supply of e-government services.

1.4.3 Project of unification of fibre-optic infrastructure in companies that are in majority ownership of the Republic of Croatia (UFOI)

In accordance with the decisions of the Government of Republic of Croatia [26], [27] adopted in 2013, the company "Transmitters and Communications Ltd." (OiV) was appointed as a contractor on the implementation of the *Project of unification of fibre-optic infrastructure in companies that are in majority ownership of the Republic of Croatia* (hereinafter UFOI). This project comprises the existing fibre-optic and cable duct infrastructure owned or managed by public companies, in order to place the capacity surplus of this infrastructure on the electronic communications market under wholesale conditions. The existing fibre-optic infrastructure includes mostly the parts of the so-called *core*

(*backbone*) network connecting the largest urban centres in Croatia along the highway and railway transport networks as well as along the energy grid (see also Chapter 1.6.3 for a detailed explanation of terms "core network" and "backhaul network").

Within the UFOI project, the OiV has the role of putting the capacities of UFOI infrastructure on the market, including the role of a service provider leasing the available UFOI capacities to all operators on the market.

The UFOI project unifies the existing fibre infrastructure of the following companies that are in majority public ownership:

- "Autocesta Rijeka-Zagreb d.d." (*Rijeka-Zagreb Motorway Plc.*; ARZ);
- "Hrvatske autoceste d.o.o." (*Croatian Motorways Ltd*; HAC);
- "Hrvatske ceste d.o.o." (*Croatian Roads Ltd.*; HC);
- "HŽ infrastruktura d.o.o." (*Croatian Railways Infrastructure Ltd.*; HŽ);
- "Jadranski nafotovod d.d." (*JANAF Plc.*; JANAF).
- "HEP Telekomunikacije d.o.o." (*HEP-Telecommunications Ltd*.);
- "PLINACRO d.o.o." (*PLINACRO Ltd.*).

As a topological continuation of the core network within the UFOI and partly using the available capacities of existing ducts within the UFOI, it is planned within the NP-BBI to build the fibre-optic infrastructure for the new NGN backhaul network in areas where operators do not have adequate NGN backhaul networks. In addition to the above-mentioned role within the UFOI, the company OiV is also appointed as the Competent Authority for the operational implementation of the NP-BBI (CAOI; for a more detailed explanation see Chapter 2.2).

1.4.4 Project „e-Schools“

The aim of the project "e-Schools" is a complete informatisation of Croatian schools with the general objective of contributing to the readiness of pupils for the labour market or further education through encouraging schools to develop digital maturity. Digital maturity is the willingness of schools and the entire education system to accept and exploit the potential of information and communication technology for supporting the improvement of teaching and business processes in schools and the school system [28].

Within the project "e-Schools" it is planned to connect the schools in Croatia via ultra-fast NGA broadband. These connections will be provided by this Programme within the project unit PU-B (connecting the public users to ultra-fast infrastructure in targeted areas of the Programme).

1.5 Procedures for the adoption and implementation of the Programme

This document defines the so-called *structural rules* of the NP-BBI in view of the NP-BBI as individual State aid. These structural rules constitute a mandatory framework laying down

all the obligatory procedures and rules that must be followed in the course of preparing and implementing the NP-BBI. These structural rules constitute also a formal framework that transfers to the NP-BBI the general rules for the application of State aid for broadband networks laid down by the Broadband Guidelines.

For clarity reasons, it should be emphasized that this structural rules primarily concern the project unit PU-A comprising the backhaul network roll-out. All the rules laid down by the NP-BBI for the project unit PU-B, related to connecting the end-users of public administration bodies, only have the function to follow the principle by which the project unit PU-B formally does not include State aid, and for which the confirmation will be obtained within the overall process of approval of the NP-BBI by the bodies of the European Commission.

It is anticipated to implement the NP-BBI in two phases. The content and scope of each phase are defined within Chapter 5.1.

1.5.1 Content of this document

This document is divided into five basic Chapters and one Annex, which is also an integral part of this document.

This introductory Chapter describes the basic starting points of the Programme and analyses the broadband access situation, particularly considering the existing backhaul networks and their possibilities of satisfying the expected traffic increase due to the introduction of new NGA networks.

The second Chapter specifies the technological, investment and business modalities of the Programme implementation.

The third Chapter describes in detail all the structural rules important for the Programme Compliance with the State aid rules:

- defining the justified areas of the Programme (hereinafter *mapping*);
- conducting the public consultation on the Programme and its particular phases;
- conducting the public procurement procedures for selecting the external providers of services related to designing, constructing, managing and maintaining the NGN backhaul network;
- defining the wholesale conditions and prices for access to the NGN backhaul network;
- defining the procedure for refunding the excessive aid (hereinafter *clawback*);
- transparency of the Programme implementation and obligations of reporting.

The fourth Chapter analyses the financial aspects of the Programme implementation based on the framework business plan prepared for this purpose.

The fifth Chapter defines the key operational aspects of the Programme implementation (prioritising the targeted areas, implementation phases of the Programme and its time-schedule, locations of main nodes and planned capacities of NGN backhaul network, as well as conducting the public consultation procedure on the Programme before initiating the pre-notification and notification procedures).

Annex provides an overview of the initially defined targeted areas of the Programme implementation in view of the categorisation of areas by colours (mapping) in accordance with the condition of access and backhaul infrastructure in all settlements in Croatia, as well as in view of the defined priorities and implementation phases of the Programme.

For the avoidance of doubt, it is necessary to specify that the concept of *targeted areas* or *targeted settlements* applies only to the areas or settlements where the Programme implementation is planned in view of the defined priorities and available financial resources, and at the same time, also to the settlements where the intervention is allowed by the Programme, given the rules of the Broadband Guidelines.

1.5.2 Formal procedure for the adoption of the Programme

Figure 1.1 shows the formal procedure for the adoption of the Programme until its approval by the European Commission with regard to the State aid rules.

The first version of this document was an initial version of the Programme that was followed by a public consultation on the Programme. The public consultation was aimed at collecting all relevant opinions, comments and suggestions related to the Programme, which generally allow improving the Programme and achieving the highest level of consensus on its implementation by all market participants, including operators. In addition, the settlement colours in accordance with the access and backhaul infrastructure condition, as well as data on the priority areas and Programme implementation phases based on the expressed interest of the operators (see Chapter 5.5), were also verified during this public consultation.

Upon completing the public consultation and amending the Programme in line with the relevant results of the public consultation on the Programme, this version of the Programme is prepared for submitting into the pre-notification procedure to the European Commission - Directorate-General for Competition (DG COMP). The purpose of pre-notification is achieving the preliminary Programme conformity with the State aid rules, i.e. preliminary removing and correcting the major non-compliances in order to carry out the subsequent formal notification procedure as soon as possible (see Chapter 1.3.2 describing the national procedures for approval of the State aid programmes laid down by the SAA).

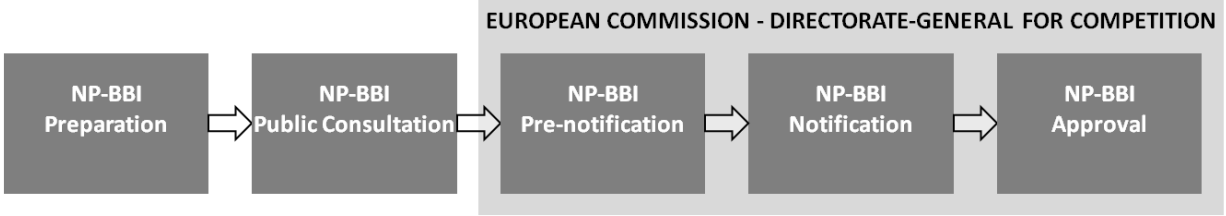

Figure 1.1 – Procedure for the adoption of the NP-BBI

1.5.3 Implementation of the Programme

Figure 1.2 gives a schematic representation of the NP-BBI implementation.

The Competent Authority for the Programme (hereinafter abbreviated as CAP[3]), as State aid granting authority, is responsible for coordinating the Programme implementation in accordance with the structural rules of the Programme and the received approval of its compliance with the State aid rules issued by the European Commission. The Competent Authority for the operational implementation of the Programme (CAOI) is the public company "Transmitters and Communications Ltd." (OiV). The explanation of a defined OiV's role within the Programme implementation is given in Chapters 1.8.4 and 2.2. In accordance with the general rules on State aid and structural rules of the Programme, the CAP must regularly report to the European Commission on the Programme implementation and the aid amounts granted.

Since the majority of the sources of funds for the Programme implementation will be provided within the ESI funds, Figure 1.2 also shows the management structure of the State administration bodies responsible for implementing the relevant OPCC, within the priority axis *Using information and communication technologies*, under the investment priority 2a *Extending broadband deployment and the roll-out of high-speed networks and supporting the adoption of emerging technologies and networks for the digital economy*.

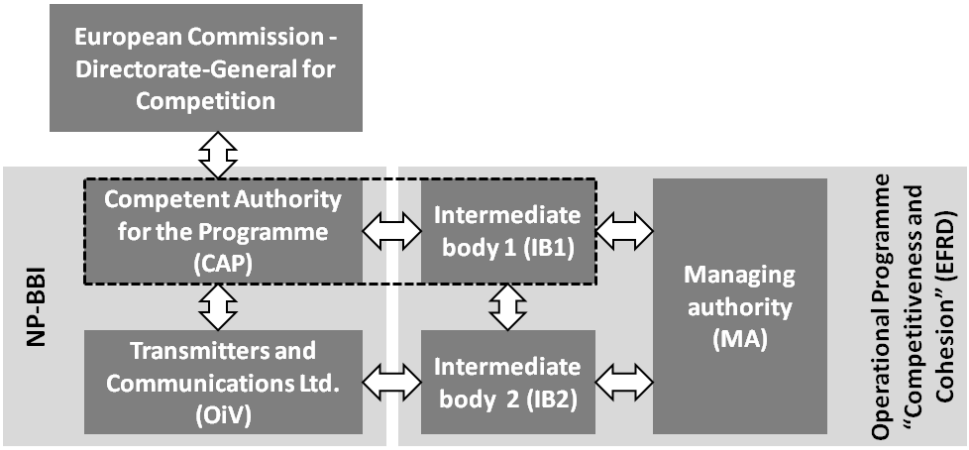

Figure 1.2 – Implementation of the NP-BBI

Regardless of the formal status of the project unit PU-A, including State aid, and project unit PU-B, not including State aid, both project units, i.e. the NP-BBI as a whole, will be co-financed by the ERDF funds within the OPCC.

This document primarily defines the Programme implementation rules in view of State aid, while all other implementation rules of co-financing from the ESI funds are specified

[3] For the purpose of uniformity, the acronym CAP will be used for the Competent Authority for the NP-BBI Programme as well as for the Competent Authority for the Framework Programme (CAOI). In practice, the functions of the CAP for the NP-BBI and the Framework Programme will be unified within the same state administration body.

within the OPCC, related bylaws, and other acts at the level of the EU and Croatia (see list in Chapter 1.2.3).

Taking into account the upcoming multi-year financial period of the ESI funds 2014-2020, the NP-BBI implementation is in line with this period. It is anticipated that the NP-BBI will be implemented by the end of 2023, that is, within the longest period in which it is formally possible to use the funds from the ESI financial period 2014-2020 [4].

The implementation of the Programme will take place in two phases formed in accordance with the defined priorities and the amount of funds available within the OPCC. In the context of ESI funds terminology, the entire Programme will be implemented as a *major project*[4].

1.6 State of supply on the broadband market

This Chapter provides a concise overview of the state of supply on the portion of the electronic communications market in Croatia related to the implementation of this Programme. This is primarily related to the broadband infrastructure and associated broadband access services as well as to the market of backhaul links used by operators to connect their national core networks to access networks. The existence of adequate backhaul links is a necessary prerequisite for achieving the availability of broadband access on the entire territory of Croatia.

1.6.1 Basic broadband infrastructure

Basic broadband infrastructure includes all infrastructural and technological solutions able to provide broadband access with speeds higher than 2 Mbit/s and lower than 30 Mbit/s. In Croatia this practically refers to DSL technologies, cable technologies up to DOCSIS 2.0, UMTS/3G wireless networks, WiMAX networks, and satellite access. The mentioned wireless technologies, including satellite access, due to the pricing characteristics of associated retail packages, cannot be considered as an appropriate market solution for the basic broadband access comparable to DSL or cable access (see detailed explanation within the Framework Programme [24]). Furthermore, given that the largest part of Croatia is covered with the basic copper twisted pair access infrastructure owned by the incumbent operator HT (a former Croatian monopolistic telecom operator), the DSL is dominant technology providing the basic broadband. Cable networks cover only the most densely populated areas within several major Croatian cities.

Table 1-1 provides an overview of the available indicators of basic broadband infrastructure coverage, along with the descriptions of their meaning and origin. According to the official data of the EU (*DAE Scoreboard* [29]), the coverage of Croatian households with fixed basic broadband access was 94.1% at the end of 2012. On the other hand, the

[4] In accordance with the provisions of the CPR [4], the project co-financed by the Structural Funds will be considered as a major project if its eligible costs exceed EUR 50 million.

data collected during the preparation of the Framework Programme [24], which is also verified through the HAKOM's Overview of Broadband Coverage (hereinafter OBC; an interactive map *Areas with the availability of broadband access* in the form of a web-application) [30], shows that 98.1% of the Croatian population is covered with the fixed basic broadband access.

Although there is a certain difference between these two indicators, it can be concluded that the overall coverage with basic broadband access in Croatia is relatively good and comparable to the EU average (95.5% at the end of 2012), or that the basic broadband access is not available to at most 5.9% of the Croatian population. For the avoidance of doubt in the remaining part of this document, the data on the availability of fixed basic broadband access collected through the Framework Programme and verified through the HAKOM's OBC (98.1%) will be considered as a relevant indicator of basic broadband access availability.

Table 1-1 – Indicators of basic broadband infrastructure availability

Indicator	Source/period	Croatia	EU average
Household coverage of fixed basic broadband access[1]	*DAE Scoreboard* [29]; end of 2012	94.1%	95.5%
Population coverage of fixed basic broadband access	Framework Programme [24], OBC [30]; middle of 2013	98.1%	-

[1] *It refers to the percentage of households that are located in areas covered by xDSL, cable and WiMAX networks.*

A detailed review of the basic broadband access availability by settlements, cities, municipalities and counties in Croatia is given in Annex, where the categorisation of areas by colours for the basic broadband access according to the definitions of the Framework Programme is used.

Figure 1.3 shows also the regional distribution of the population availability of basic broadband access per Croatian counties. It is noticeable that the availability of basic broadband access is above the Croatian average in the majority of counties (14 out of 21), while the remaining seven counties are below the average, where the worst basic broadband access availability is in counties Šibenik-Knin (91.9%), Lika-Senj (90.5%) and Brod-Posavina (87.5%).

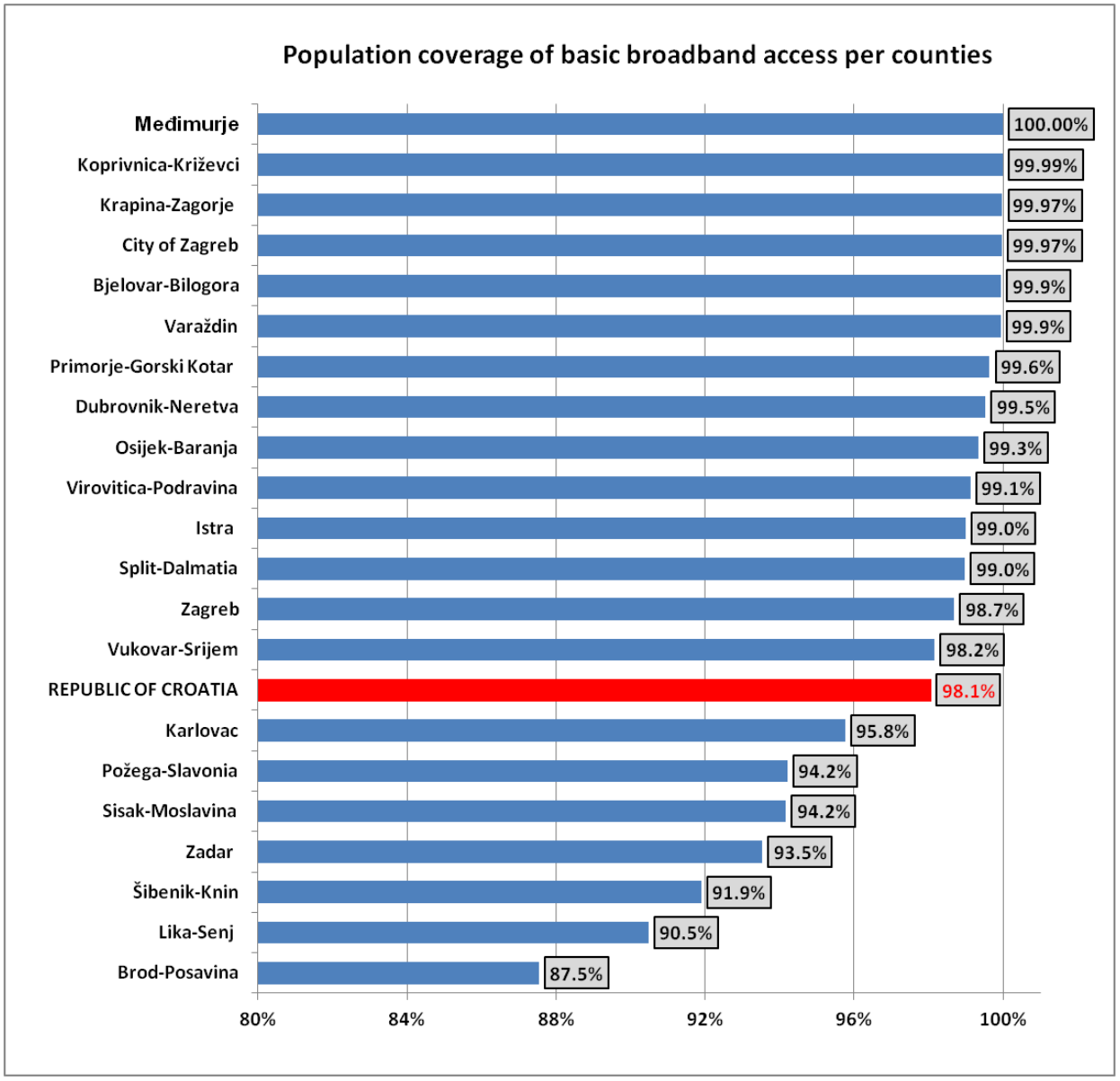

Figure 1.3 – Population coverage of basic broadband access per counties

1.6.2 NGA broadband Infrastructure

NGA broadband, i.e. NGA networks, include all infrastructural and technological solutions which *rely wholly or partly on optical elements and which are capable of delivering broadband access services with enhanced characteristics as compared to existing basic broadband* networks [16]. NGA networks can provide fast and ultra-fast access with speeds higher than 30 Mbit/s. This speed refers informally only to the direction towards the end-user (*downstream* in fixed networks or *downlink* in wireless networks). However, the importance of ensuring higher speeds, in comparison with the existing basic broadband networks, also in the opposite direction, from the end-user (*upstream* in fixed networks or *uplink* in wireless networks), is also emphasized for NGA networks. The NGA can be provided via FTTx infrastructural solutions (FTTH, FTTB, FTTC, HFC), possibly in combination with VDSL or cable DOCSIS 3.0 technologies, as well as via advanced wireless technologies (e.g. LTE-Advanced) whose implementation is matched to the needs of fixed broadband access.

The process of building new NGA networks and/or upgrading the existing basic broadband networks to NGA networks is relatively slow in Croatia due to the small investments by operators. Few years ago, the HT built its FTTH network in parts of largest Croatian cities (Zagreb, Split, Rijeka and Osijek), which contributes up to 20% to the population availability of NGA at the national level. In the same areas, the leading cable operator B.net (formally part of the second largest national operator VIPnet) partly upgraded its cable network to DOCSIS 3.0. Furthermore, the operator Amis Telekom also built few FTTH networks and announced plans for the further building of FTTH networks in some of the most densely populated parts of Zagreb. The roll-out of FTTH networks in the same parts of Zagreb has been planned and partially started by the city utility company Zagreb City Holding [31]. It is noticeable that the majority of current and announced investments are concentrated in areas of major Croatian cities.

Consequently, in contrast to the basic broadband coverage, the NGA coverage of Croatian households is relatively small compared to the EU average (see Table 1-2), which placed Croatia at 27th place among the 28 Member States of the EU according to the data from the end of 2012. The recent data obtained through the analysis performed during the preparation of this Programme and based on the HAKOM's OBC shows that the population coverage of NGA broadband in Croatia at the end of the first quarter of 2014 was 29.6%[5]. Since the HAKOM's OBC is regularly updated in line with the data provided by the operators on the Croatian market, this NGA population coverage value is the most recent and will be considered as relevant for the purposes of this Programme.

Table 1-2 – Indicators of NGA broadband infrastructure availability

Indicator	Source/time period	Croatia	EU average
Household coverage of fixed NGA broadband[1]	*DAE Scoreboard* [29]; end of 2012	19.1%	53.8%
Population coverage of fixed NGA broadband[2]	OBC [30]; Q1 2014	29.6%	-

[1] It refers to the percentage of households that are located in areas covered by FTTH and FTTB networks, HFC cable networks using minimum DOCSIS 3.0, VDSL networks, and all other networks capable of providing access with at least 30 Mbit/s.

[2] It does not include NGA wireless technologies (e.g. LTE), because the current implementation practice of these technologies in Croatia is mainly aimed at users of mobile networks or at users of fixed networks only in order to achieve the basic broadband access coverage. Therefore, the actual capacity and bandwidth of LTE networks cannot provide the stable NGA with a minimum speed of 30 Mbit/s.

A detailed overview of the NGA availability by settlements, towns, municipalities and counties in Croatia is given in Annex.

Figure 1.4 shows the distribution of the population availability of NGA broadband per Croatian counties. With the exception of Primorje-Gorski Kotar (60.3%), the availability of

[5] Data from the HAKOM's OBC showing the availability of NGA broadband in Croatia is primary related to the availability of infrastructure that can provide services with speeds above 30 Mbit/s (fast broadband access). In this respect, the referenced data from the HAKOM's OBC should not be directly linked also with the actual utilisation level of broadband access with speeds above 30 Mbit/s by the end-users and the area colours related to the NGA broadband that will be determined through the mapping procedures within the projects in the scope of the Framework Programme.

the NGA in all other counties is less than 50%, where the worst availability is in counties Krapina-Zagorje (2.1%), Vukovar-Srijem (1.0%) and Virovitica-Podravina (0.4%).

Considering the distribution of the population availability of NGA broadband at the level of the LSUs (cities/towns and municipalities), it is evident that the NGA broadband is currently completely inaccessible in more than half of the LSUs, while in only 3% of the LSUs the availability of NGA broadband is more than 50% (see Figure 1.5).

Overall, the NGA broadband availability indicators point to a very unsatisfactory situation in Croatia and lagging behind the EU framework, leading to the necessary implementation of State aid programmes aimed at fostering the deployment of broadband networks, including the Framework Programme and the NP-BBI.

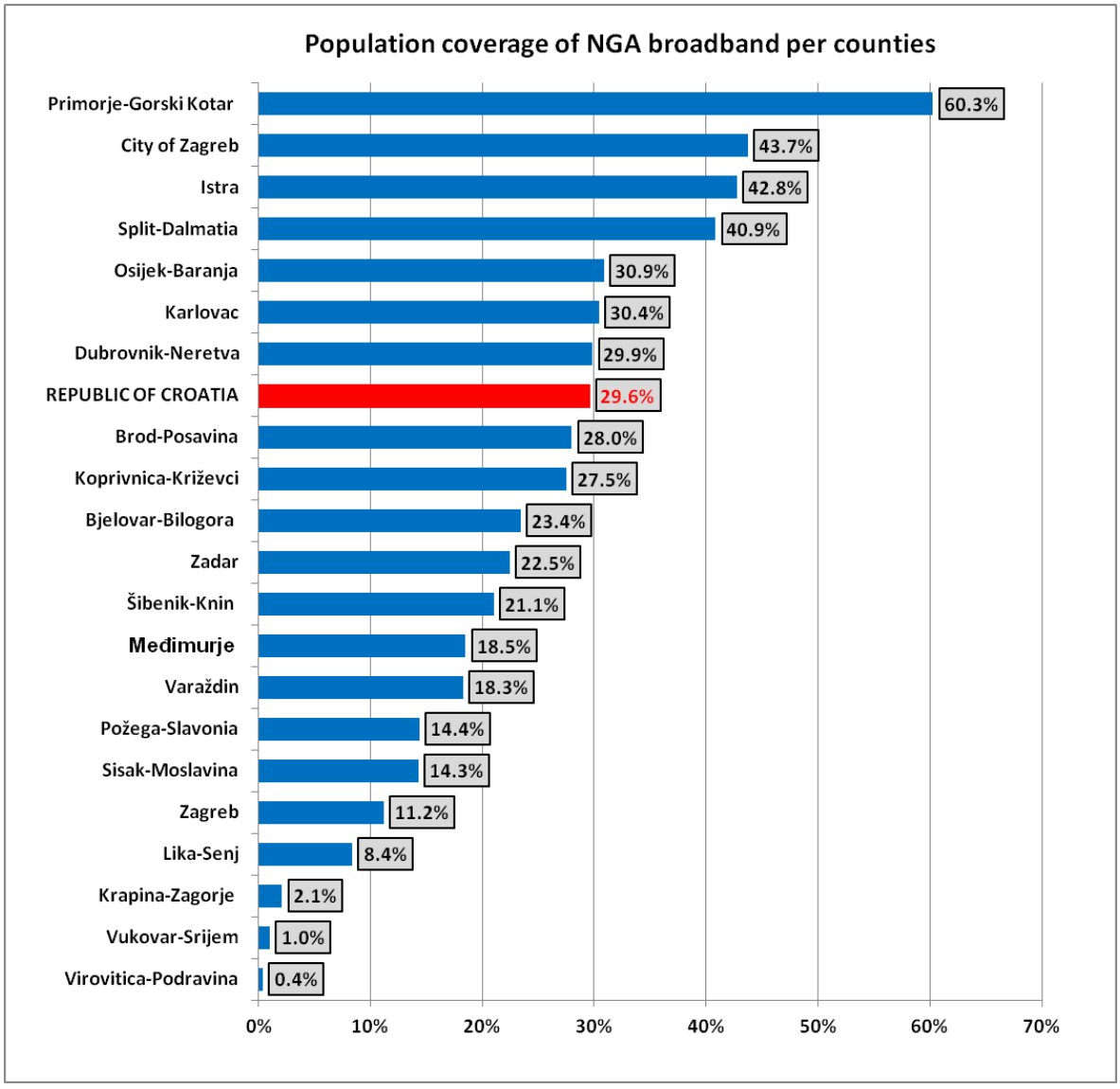

Figure 1.4 – Population coverage of NGA broadband per counties (Q1 2014)

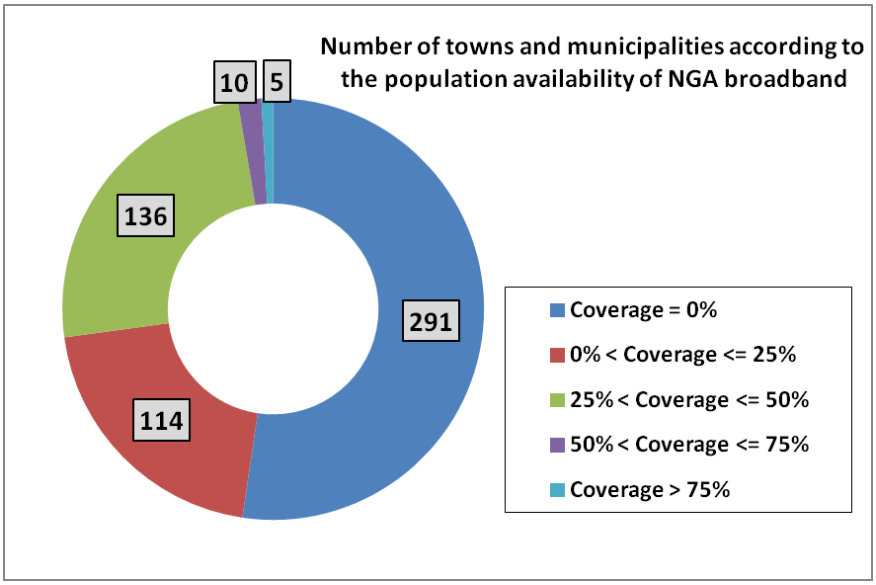

Figure 1.5 – Distribution of the LSUs by the level of NGA broadband availability (Q1 2014)

1.6.3 Backhaul infrastructure

For the purpose of the terminology uniformity in this document and the avoidance of doubt, Figure 1.6 schematically shows the basic hierarchy of telecommunications networks, that is, the division into core (*backbone*), backhaul (*aggregation*; *middle-mile*), and access (*last mile*) networks. Core networks usually comprise the main network nodes located in the largest cities and the interconnection links between these nodes. Backhaul links interconnect the core network nodes and the access nodes within the access network[6]. Such backhaul links also imply the backhaul network nodes located at the transitions to the core and access networks (typically co-located with the core network nodes and access nodes). Geographically, backhaul links are commonly spreading from major cities, where core nodes are located, to all the other smaller towns and settlements where access network nodes are situated.

The availability of contemporary NGN backhaul links based on fibre-optic infrastructure is a necessary prerequisite for achieving the availability of NGA broadband in all parts of Croatia. The capacity, geographical distribution, market availability and openness of backhaul links must provide all operators with the open access to the access networks and individual end-users in settlements, ensuring that all end-users have the equal opportunities of choosing the broadband access operator and broadband services. Therefore, the backhaul links are an essential infrastructural resource ensuring also the implementation of the Framework Programme as well as reaching the strategic objectives of the DAE.

[6] Although Figure 1.6 shows the backhaul links in star topology, it is only an illustrative representation that does not necessarily reflects the actual topology of the existing backhaul network in Croatia nor the topology of the backhaul network that will be built within this Programme.

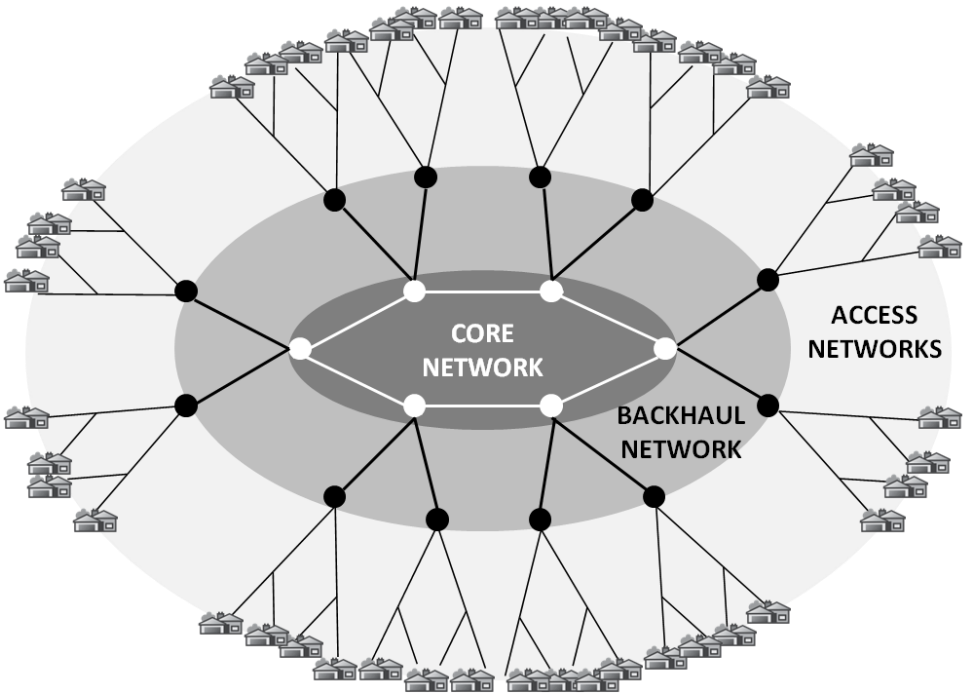

Figure 1.6 – Basic hierarchy of telecommunications networks

The majority of the existing backhaul links in Croatia are built and managed by the HT. These backhaul links follow the historical architecture and nodes of a traditional fixed network for public telephony (*plain old telephone system* - POTS), reaching the HT's telephone exchanges in settlements[7]. The access nodes in rural areas of Croatia are generally located in the settlement centres. The copper twisted pair network associated to a particular access node usually includes also several neighbouring settlements if these settlements have a small number of inhabitants (typically up to 200 inhabitants).

Because this Programme includes the backhaul network, it is particularly important to analyse objectively the condition of the existing backhaul infrastructure and the suitability of that infrastructure for the acceptance of the expected increase in data traffic due to the implementation of new NGA networks. This analysis is given in detail in Chapter 1.8.1.

The precise partition between the core and backhaul network in Croatia, in terms of geographical locations of transitional nodes between the core and backhaul network, will be matched to the needs of the project unit PU-A and condition of all existing operators' core networks, including also the fibre-optic infrastructure of the UFOI. The locations of the transitional nodes are verified through the public consultation (see Chapters 5.3.1 and 5.5).

[7] An informal term "RSS" (emanating from *Remote Subscriber Stage*) is also often used for the telephone access exchange within the HT's network.

1.7 State of demand on the broadband market

Table 1-3 provides an overview of the basic indicators of demand and utilisation of fixed broadband access in Croatia. Compared to the EU average, it is noticeable that Croatia is lagging in view of the number of fixed broadband connections (regarding the population penetration Croatia is ranked 24th among the 28 EU countries) as well as in view of the number of households equipped with broadband connections. It is also noticeable a weak increase of the population penetration of broadband in Croatia on an annual basis (less than 1 percentage point at the end of 2013), which also makes more difficult reaching the European average.

Table 1-3 – Indicators of broadband access utilisation in Croatia

Indicator	Source/time period	Croatia	EU average
Population penetration of fixed broadband access[1]	*DAE Scoreboard* [29]; end of 2012	20.8%	28.8%
Population penetration of fixed broadband access [1]	*HAKOM [32]*; end of 2013	21.6%	30,1%
Households with broadband access[2]	*DAE Scoreboard* [29]; 2013	63.6%	75.9%

[1] *It refers to the number of fixed broadband connections in relation to the total number of inhabitants.*
[2] *Only households with at least one member aged between 16 and 74 years are covered.*

An uneven distribution of the utilisation of fixed broadband access per Croatian counties (see Figure 1.7) is also noticeable. The population penetration of fixed broadband access is lower than the national average even in 14 counties. The utilisation of fixed broadband access in Požega-Slavonia County (the worst case) is almost twice lower than the utilisation in City of Zagreb and Zagreb County (the best case).

According to the HAKOM's OBC [30], in the middle of 2014 in Croatia were only 0.65% of broadband connections with speeds above 30 Mbit/s. Two leading operators, the HT and VIPnet, each of which realises the population coverage of NGA infrastructure of more than 10%, started to offer a year ago also the broadband retail packages with speeds higher than 30 Mbit/s, where the retail prices of such packages are at least twice the retail prices of packages providing broadband connections with basic speeds[8]. Such a situation certainly could not contribute to a significant increase in the number of fast and ultra-fast broadband connections in the previous period. For comparison, the number of fast and ultra-fast fixed broadband connections at the level of the EU in the middle of 2013 was 18.2%, where the

[8] HT - the fees for FTTH access with speeds of 40-100 Mbit/s are approximately 2 times higher than the fees for basic ADSL package of 4 Mbit/s [33]; VIPnet (B.net) - the fees for cable access with speeds of 42-120 Mbit/s are 2.9 to 3.7 times higher than the fee for access with basic speed of 10 Mbit/s [34]

prices of retail packages providing the fast and ultra-fast access were on average only 19% higher than the prices of retail packages providing the basic access speeds [29][9].

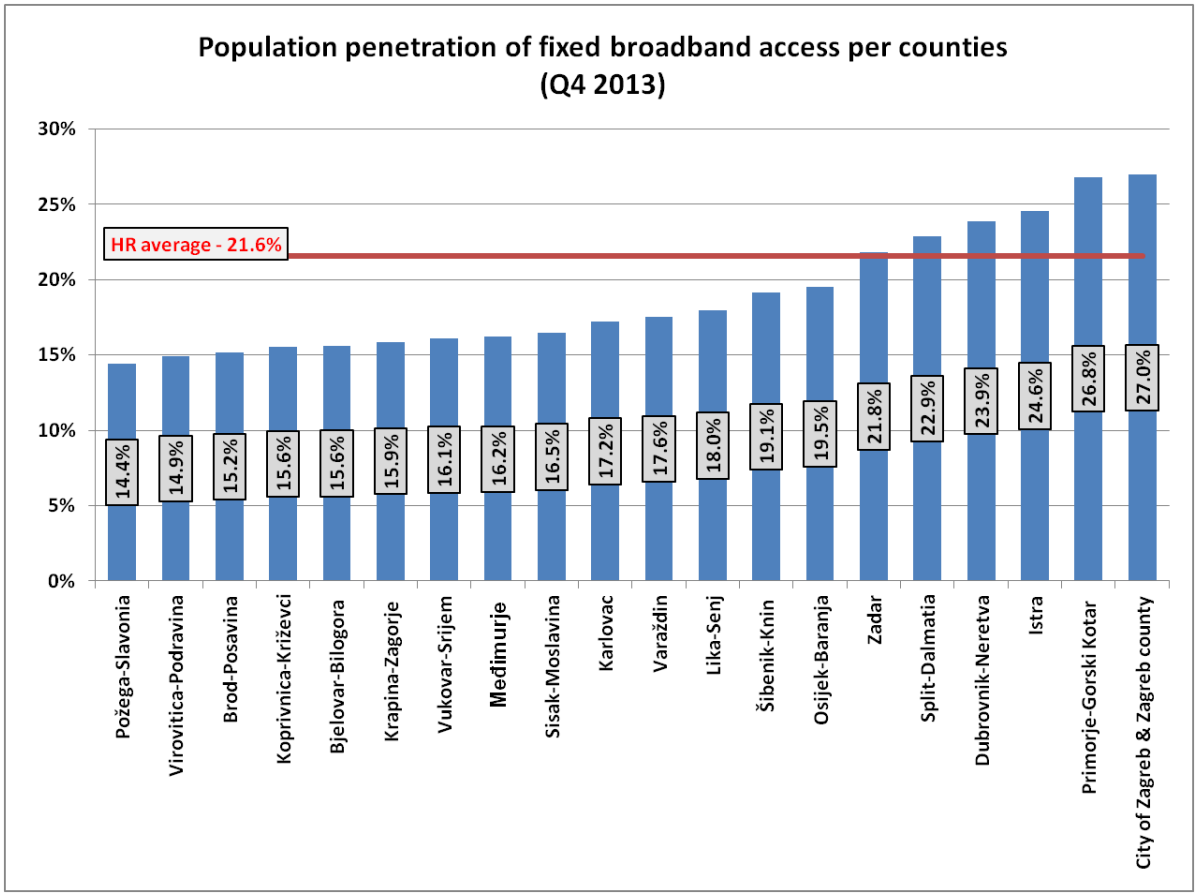

Figure 1.7 – Population penetration of fixed broadband access per Croatian counties (Q4 2013)

An average of individual measurements of the maximum speeds of broadband connections that regularly carries out and aggregates American company Ookla [35] can be used as an indicator of the NGA progress. Figure 1.8 shows such average bandwidths of broadband connections for EU countries (with the exception of Malta) recorded during April 2014. It is noticeable that Croatia is ranked last among all the EU countries presented, with the average bandwidth of broadband connections more than 5 times lower than the corresponding values in even seven leading EU countries. Although there are certain reservations regarding the methodological reliability of measurements carried out by the company Ookla and possible inaccuracies of stated values ranging up to 20% compared to the actual situation, the qualitative picture of NGA broadband in Croatia hereby essentially does not change and still indicates a significant lag behind the majority of EU countries.

[9] The speeds declared in retail packages were taken into account. The average price at EU level is calculated by adjusting the purchasing power parity per Member States and refers to the average price of retail packages with access speeds higher than 30 Mbit/s. The prices of basic speed access refer to packages with speeds between 8 and 12 Mbit/s.

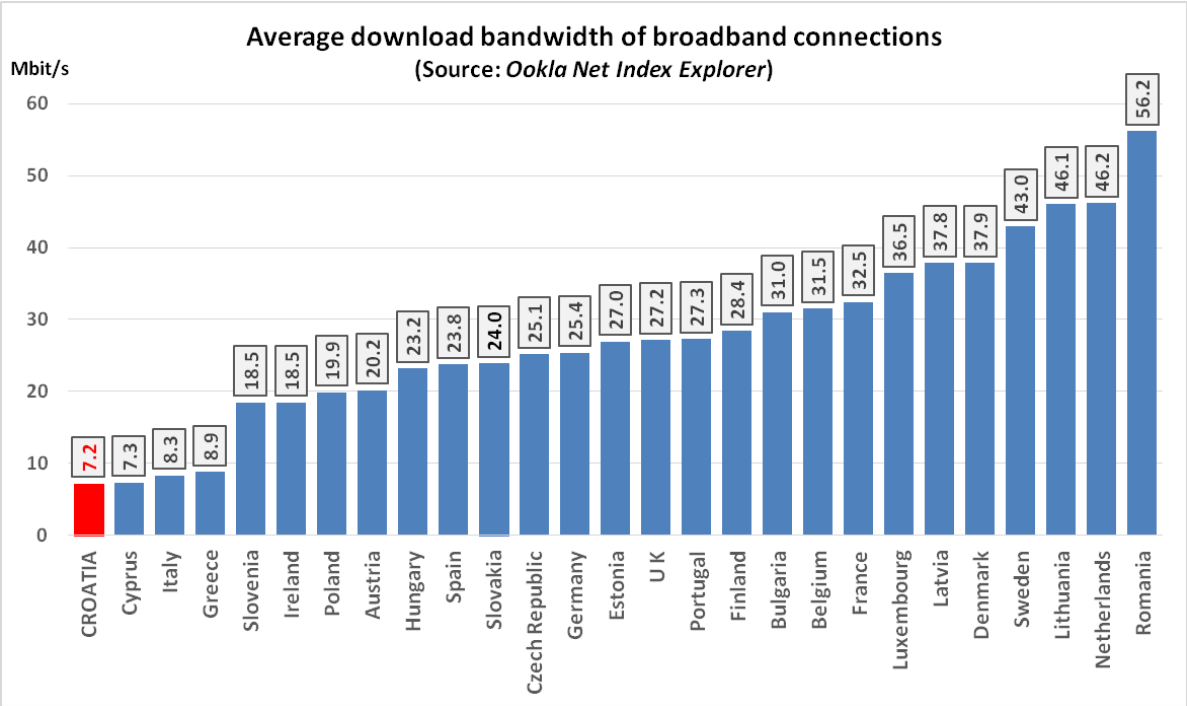

Figure 1.8 – Average download bandwidth of broadband connections

Overall, it can be concluded that the state of the broadband access utilisation in Croatia is unsatisfactory, both at the average national level and at the regional levels, given the large differences in the utilisation of broadband access among the Croatian counties. In addition, the utilisation of fast and ultra-fast access via NGA networks is exceptionally low compared to the relevant EU averages. Such a situation indicates the necessity of carrying out the Framework Programme and the NP-BBI, as complementary State aid programmes ensuring the basic infrastructural prerequisites for increasing the utilisation of NGA broadband. In addition, the importance of the NP-BBI is particularly reflected through the provision of infrastructure of open backhaul links for connecting the access networks in Croatian settlements with operators' core networks, which ensures also the prerequisites for the presence of multiple operators and service providers in access networks and increasing the market competitiveness at the retail level, that is, increasing the number and quality of retail broadband packages for the benefit of end-users.

Apart from the above-mentioned infrastructural prerequisites achieved through the Framework Programme and the NP-BBI, the increase in broadband access demand will be achieved also through the development of e-services by the State (see Chapter 1.4.2), where the provision of infrastructural availability of the NGA broadband for the public administration bodies within the project unit PU-B also plays an essential role.

1.7.1 Analysis of growth of required capacities in access and backhaul networks

In order to analyse the required NGN backhaul capacities, it is necessary, using appropriate methods, to estimate the increase in data traffic in access networks caused by the implementation of NGA technologies and general market trends in development of retail services provided over broadband connections. The main parameter determining the

required backhaul network capacity is the sum of maximum bandwidths (speeds) of individual broadband connections in access networks, expressed in Mbit/s or Gbit/s.

The following assumptions have been applied in estimating the increase of speeds in access network:

- the targeted period of this estimate covers the next 20 years (2016-2035), in accordance with the longest reference period for the analysis of broadband infrastructure projects recommended by the European Commission [36];
- this estimate comprises the average of the actual maximum speeds of broadband connections in access networks achievable according to the technological capabilities of the access network, the operator's commercial offer, and the willingness of users to use these speeds, i.e. to pay the retail fees for such broadband connections available on the market;
- the available data on average maximum speeds of broadband connections in Croatia published by the European Commission [37] and the company Ookla [35], as well as the equivalent average data for EU countries[10] for the purpose of applying the method of benchmarking, are used as the baseline values for the estimate;
- in areas of Croatia where NGA networks will be implemented, the average maximum speeds of broadband connections will be comparable with the estimated averages and the estimated growths in speeds at the EU level, that is, in a period of a maximum of four years from the implementation of NGA networks the current lag of the average values of maximum speed of broadband connections in Croatia in relation to the European averages will be compensated;
- the average maximum speeds of broadband connections in access networks depends also on the applied NGA technology, where the constraints regarding the growth of average maximum speeds will be noticeable in access networks that use the architecture with optical fibres only in the portion of the network, without the full implementation of optical fibres all the way to the end-users (i.e. FTTx network architecture in comparison with the FTTH network architecture)[11].

Following the above-mentioned assumptions and depending on the applied NGA technology in the access network within the framework of the Framework Programme, two basic scenarios considering the growth in average maximum speeds of broadband connections and marked as "FTTH scenario" and "FTTx scenario" are formed. In line with the

[10] According to [35], the average speed of broadband connections in the EU at the beginning of 2014 was 23.8 Mbit/s, with the compound annual growth rate (CAGR) of 28.6% in the period 2008 - 2014. At the same time, the average speed of broadband connections in Croatia at the beginning of 2014 was only 7.1 Mbit/s, with the average annual compound growth rate in the period 2008 - 2014 of only 16.4%. For additional comparison, according to [37], the average speed of broadband connections in the EU was 19.5 Mbit/s at the beginning of 2012 and 30.7 Mbit/s at the end of 2013.

[11] For example, the FTTC network architecture applying VDSL technologies, where the achievable maximum speeds are determined by technological capabilities of VDSL technology used (e.g. vectoring techniques) and average length of the remaining segments of copper sub-loops.

objectives of economic efficiency of investments and State aid within the Framework Programme, it is assumed that FTTH networks will be mainly implemented in settlements with more than 5,000 inhabitants, while FTTx network architectures will be implemented in the remaining, smaller settlements.

At the EU level, in accordance with the current trends, it is estimated that the baseline value of average maximum speeds of broadband connections in 2015 is 33.0 Mbit/s, with the compound annual growth rate (CAGR) of 25.3% in the period 2015-2020, and the subsequent lower value of 4.8% in the period 2020-2035.[12] In accordance with the estimated changes in average values at the EU level and the assumption of reaching the European averages, the following values of relevant parameters are estimated for Croatia (see Table 1-4): the baseline values of average maximum speeds of broadband connections in 2015 are 30 Mbit/s for both scenarios, the compound annual growth rate of maximum access speeds in the period 2015-2020 is 27.5% for FTTH scenario and 15.9% for FTTx scenario, and the compound annual growth rate of maximum access speeds in the period 2020-2035 is 6.7% for FTTH scenario and 2.2% for FTTx scenario.

Table 1-4 – Estimates of basic parameters describing the increase in average maximum speeds of broadband connections in access networks in the EU and Croatia

Indicator	Baseline value 2015 (Mbit/s)	CAGR (2015-2020)	Estimated value 2020 (Mbit/s)	CAGR (2020-2035)	Estimated value 2035 (Mbit/s)
EU average	33.0	25.3%	101.8	4.8%	204.3
Croatia, FTTH scenario	30.0	27.5%	101.2	6.7%	266.7
Croatia, FTTx scenario	30.0	15.9%	62.6	2.2%	86.7

Figure 1.9 shows the estimated growths in average maximum speeds of broadband connections.

In line with the estimated average speeds of broadband connections in access networks in targeted settlements of the NP-BBI, the estimated values of the required total capacity of the NGN backhaul per counties for the years 2022 and 2035 are shown below (see also Chapter 5.1). In addition to the above-mentioned assumptions regarding the average speeds of broadband connections in access networks, for the calculation of the required total capacity of the NGN backhaul also the following additional assumptions were applied:

- the average share of households with a broadband connection will be 80% in 2022 and 90% in 2035[13];

[12] The estimated increase in the period 2015-2020 is primarily in line with the need of achieving the third objective of the DAE related to the use of ultra-fast broadband connections (with speeds of more than 100 Mbit/s) in at least 50% of European households.

[13] In September 2014, the ratio of the number of fixed broadband connections and the total number of households in Croatia was 0.615. In the same period, the population penetration of fixed broadband connections was 22.0% [32]. Both indicators include also the fixed broadband connections of business and public users.

- the average share of broadband connections utilised by business and public users is 5% of the total number of broadband connections in the targeted settlements;
- the average ratio of the sum of actual maximum speeds of all fixed broadband connections and the maximum backhaul network capacity (the so-called *contention rate* or *oversubscription rate*) will amount to 15 in 2022 and 12 in 2035.

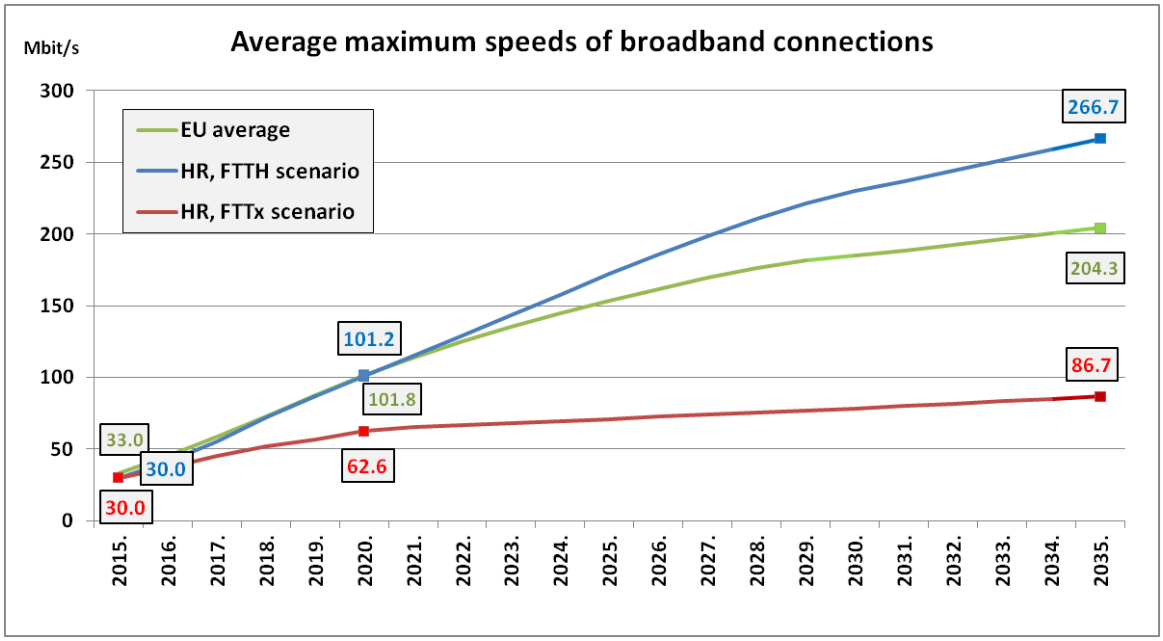

Figure 1.9 – Estimated growths in average maximum speeds of broadband connections (2015-2035)

Table 1-5 shows the estimates of required backhaul network capacities per counties in 2022 and 2035 (data is shown for 2022 as the year for which the completion of the NP-BBI implementation is planned - see also Chapter 5.2). The data shown in Table 1-5 includes the total aggregated capacities per counties while the actual backhaul network capacities per backhaul network segments connecting the individual settlements within the county depend on the topological solution of the network and location of the transitional node to the core network (see also Chapter 5.3).

For the purpose of illustration, Table 1-5 shows also the estimates of currently used backhaul network capacities for the needs of all existing fixed broadband connections in Croatian counties according to the data on the number of broadband connections per county at the end of the third quarter of 2014 [32] as well as the data on the average maximum capacity of broadband connections in Croatia at the beginning of 2014 [35].

The backhaul networks capacities required for transmission of IPTV services to individual users are not specified separately within this calculation of required backhaul network capacity. It is assumed that adequate capacities for transmission of IPTV services are already included within the values of average maximum speeds of individual broadband connections.

Table 1-5 – Estimates of required NGN backhaul capacities per counties in 2022 and 2035

County	Population of the settlements covered by the NP-BBI	Share of the county population covered by the NP-BBI	Estimate of utilised backhaul network capacity, (Gbit/s)[1]	Estimate of required backhaul network capacity, (Gbit/s)[2]	
			2014	2022	2035
Bjelovar-Bilogora	63,246	53.8%	5.4	137.7	356.7
Vukovar-Srijem	157,700	87.8%	8.3	340.8	879.5
Split-Dalmatia	131,606	28.9%	30.7	244.3	570.7
Primorje-Gorski Kotar	107,537	36.3%	23.0	193.6	442.0
Lika-Senj	25,773	50.6%	2.6	45.6	102.5
Sisak-Moslavina	51,762	30.0%	8.1	101.6	246.8
Požega-Slavonia	41,776	53.5%	3.2	85.6	214.0
Krapina-Zagorje	40,550	30.5%	6.1	58.0	105.5
Virovitica-Podravina	50,820	59.9%	3.6	113.2	297.1
Šibenik-Knin	27,107	24.8%	6.4	47.7	107.0
Karlovac	18,291	14.2%	6.4	34.1	80.0
Varaždin	42,871	24.4%	9.0	68.3	139.8
Zadar	55,289	32.5%	11.0	86.5	173.9
Dubrovnik-Neretva	75,731	61.8%	8.7	174.3	465.7
Brod-Posavina	60,193	38.0%	6.9	101.8	220.4
Istra	78,305	37.6%	15.7	161.1	403.6
Međimurje	73,495	64.6%	5.5	125.2	273.0
Koprivnica-Križevci	47,949	41.5%	5.0	91.9	219.6
Osijek-Baranja	137,027	44.9%	17.0	290.3	740.3
Zagreb & City of Zagreb	177,321	16.0%	24.9	376.3	960.6
CROATIA TOTAL	**1,464,796**	**34.2%**			

[1] The estimate is based on the number of fixed broadband connections per counties at the end of the third quarter of 2014 [32] and the average maximum speed of broadband connections at the level of Croatia [35], for all settlements within the particular county. Data does not necessarily reflect also the actual installed capacities of the existing backhaul network.

[2] The estimated capacity includes only the traffic from targeted settlements of the NP-BBI (according to the share of the population covered by the NP-BBI in each county).

It is also important to note that the capacities listed in Table 1-5 include only the aggregated capacities from access networks in targeted settlements of the NP-BBI implementation in the period up to 2022. In this regard, the necessary backhaul network capacities in the period after 2022 probably will be higher, taking into account the expected implementation of additional State aid programmes for broadband infrastructures in other smaller settlements within the counties that currently are not the targeted settlements within the NP-BBI implementation.

The comparison of the estimated backhaul network capacities in 2014 and the estimated required capacities in 2022 and 2035 indicates a multiple increase of required backhaul network capacities. Depending on the county, this increase is 5.3 to 41.3 times in the period 2014 to 2022, and in total 12.5 to 106.5 times in the period from 2014 to 2035.

1.8 Options for ensuring the required capacities in the NGN backhaul

In accordance with the results of the analysis of the backhaul network capacity growth in the period up to 2035 presented in Chapter 1.7.1, it is necessary to define the best option that ensures the required backhaul network capacities in a long-term (*future proof*) sustainable way. Consequently, and following the results of the conducted public consultation on the Programme, this chapter summarizes the condition of the existing backhaul network and analyses two identified basic options for increasing the backhaul network capacity. The first option anticipates upgrading the existing HT's backhaul network while the second option anticipates building the new backhaul network based on passive fibre-optic cable infrastructure. The second option represents the selected implementation modality of the Programme, which is also explained in detail in this Chapter.

Given that operators involved in the public consultation, including the HT, presented also the confidential information about the condition of their existing backhaul networks, only basic data and facts that are not of a confidential nature and that are relevant for making the decision on the selected modality of the Programme implementation are provided within this document.

1.8.1 Condition of the existing backhaul network

As already stated in Chapter 1.6.3, in all targeted areas of the Programme implementation only the HT has an existing backhaul network. In the majority of settlements the HT's backhaul network is based on the fibre-optic infrastructure, with a variety of transmission technologies implemented on an active network layer, from which the *Ethernet* technology can be considered as being able to provide the necessary features and capabilities for the purposes of the NGN backhauls, primarily due to the scalability of transmission capacities, ranging from 100 Mbit/s to 100 Gbit/s using a single optical fibre and/or a pair of optical fibres, as well as due to the support of multiservice data transmission over IP while ensuring the required quality of service (hereinafter QoS) [14].

Besides Ethernet, also the *Wavelength Division Multiplexing* (hereinafter WDM) technology in general is considered as NGN technology being able, where appropriate, to multiply the capacity of a single pair of optical fibres by simultaneous transmission of data belonging to several different communications channels at several different wavelengths within a single optical fibre. Like Ethernet, the WDM technology also requires the application of specific active network equipment on top of the basic passive infrastructure of optical fibres.

Given the data provided by the HT during the public consultation on the Programme, the analysis of the condition of the existing HT's backhaul network determined that, considering its currently installed capacities on the network active layer in the targeted settlements of the NP-BBI, this backhaul network is not capable of ensuring the estimated

[14] Other transmission technologies that cannot be regarded as NGN technologies include primarily traditional PDH/SDH technologies (commonly referred as *legacy transmission technologies*).

increase in required backhaul capacity due to the introduction of new NGA networks in the period of the next 20 years according to the analysis carried out in Chapter 1.7.1.

The analysis of the condition of existing HT's backhaul network is appropriately reflected also in the process of determining the colours (mapping) of targeted settlements regarding the availability of NGN backhaul infrastructure, explained in detail in Chapter 3.1.

1.8.2 Option of upgrading the existing HT's backhaul network

Due to unprofitability of investments in expansion of existing backhaul network capacities under normal market conditions, State aid would co-finance the capacity expansion of the existing HT's backhaul network. In a majority of the targeted settlements of the NP-BBI this expansion would mainly include upgrading the HT's backhaul network by placing the additional active network equipment based on NGN technologies (Ethernet, and WDM where appropriate), in order to ensure the necessary capacity in line with the estimated increase of required capacity over the next 20 years. In a minority of the targeted settlements of the NP-BBI in which there is currently no fibre-optic infrastructure, this option would include also the construction of the necessary fibre-optic infrastructure.

The business model in this option would comprise leasing the transmission capacities of a guaranteed speed on an active network layer, ranging in capacity from 100 Mbit/s to 100 Gbit/s (and more, according to demand and the development and availability of faster network interfaces on the market), for the needs of operators within the project unit PU-A and public users within the project unit PU-B.

Since this option would rely on existing HT's network infrastructure, an investment model of direct subsidisation of the private operator (the so-called *private DBO* or *operator subsidy (gap funding) model*[15]) would be applied. The part of required investment funds would be provided through State aid, and the remaining complementary part should be ensured by the HT, in proportion to the State aid share (i.e. *State aid intensity*).

The estimated investment amount for implementing this option is HRK 391.7 million. This estimate is based on the assumption of installing the new active network equipment (Ethernet, and WDM where appropriate) in the majority of targeted settlements where currently exists the appropriate fibre-optic backhaul infrastructure, and additionally on the assumption of constructing the appropriate fibre-optic backhaul infrastructure to the targeted settlements of the NP-BBI where currently this infrastructure does not exist. Given the targeted period of the NP-BBI analysis (20 years) and the average life-span of active network equipment (12 years), after the expiration of the life-span of initially installed active network equipment, this equipment should be replaced with the new active network equipment, which would result in additional capital costs that would be comparable with the estimated initial amount (taking into account the expected drop in prices of active network equipment, but also the estimated further increase of the required transmission capacities of the NGN backhaul up to 2035).

[15] Within the Framework Programme such an investment model is referred to as *investment model A*.

1.8.3 Option of building the passive fibre-optic backhaul infrastructure

Besides the above-described option of upgrading the existing HT's backhaul network, the option of constructing the passive fibre-optic backhaul infrastructure based on dark fibres to all targeted settlements of the NP-BBI is analysed. For the purpose of laying these fibre-optic cables, this option assumes also the construction of new cable ducts on the routes where there is no cable ducts or where the existing HT's cable ducts, or the cable ducts within the UFOI, do not have sufficient free capacities for accepting these additional fibre-optic cables.

The business model in this option involves the leasing of dark fibres to the operators within the project unit PU-A and public users within the project unit PU-B. In this way, the operators using leased dark fibres on a passive network layer of the NB-BBI are responsible for their own implementation of data transmission on an active network layer, having the possibility to customize it fully to their own preferences and capacity needs. Thus, this option has technologically neutral characteristics.

In this option, the public investment model (the so-called *public DBO* or *public-run network model*)[16] would be applied, where the public company "Transmitters and Communications Ltd." (OiV), wholly owned by the State, would have the operational responsibility for the Programme implementation, including the planning and construction of the NP-BBI fibre-optic backhaul infrastructure as well as the operational management of the fibre-optic infrastructure built within the NB-BBI.

The estimated investment amount for implementing this option is HRK 679.6 million (a more detailed analysis of the financial aspects of this option, as the selected implementation option for the Programme, is given in Chapter 4). Given that the investment in this option is related only to passive network infrastructure with an expected life-span of between 20 and 40 years, any eventual subsequent capital costs of replacing this infrastructure within the targeted period of the NP-BBI analysis need not be taken into account.

1.8.4 Rationale for selection of the NP-BBI implementation option

The selected implementation option of the NP-BBI is the option of building the passive fibre-optic backhaul infrastructure implementing the public DBO investment model. Taking into account the above-presented characteristics of both options considered, the option of building the passive fibre-optic backhaul infrastructure has the following comparative advantages with regard to the option of upgrading the existing HT's backhaul network:

- the construction of passive fibre-optic backhaul Infrastructure ensures the long-term sustainable solution on the market, given the life-span of fibre-optic cables and related infrastructure for the installation and protection of fibre-optic cables (20-40 years), and there are no additional costs associated with the replacement of any active network equipment within the analysed period of the Programme by

[16] Within the Framework Programme such an investment model is referred to as *investment model B*.

2035, as it is the case for the option of upgrading the existing HT's backhaul network;

- in view of the above-mentioned, the initial advantage of lower capital costs (up to 42%) in the option of upgrading the existing HT's backhaul network, regarded in general and over a longer time period, is not a viable advantage of this option, given the period of the NP-BBI analysis of 20 years and the additional costs for replacing the active network equipment after an average life-span of 12 years, where these costs would be presumably at the same level as the initial procurement costs of active network equipment;
- the option of implementing the passive fibre-optic infrastructure, i.e. the infrastructure of dark fibres, represents a technologically neutral solution that, due to the extremely high data transmission capacity of an optical fibre as a physical data transmission medium, allows implementing a number of currently available transmission technologies on an active network layer as well as expected new transmission technologies that will be available on the market during the life-span of this passive fibre-optic infrastructure;
- the option of implementing the passive fibre-optic infrastructure whose capacities are available on the wholesale market for leasing to all operators as service providers in the NGA networks, has a particularly positive effect on the competitiveness of operators on the market since it enables the investments of all operators in NGA networks and the market competition on the infrastructure level, ultimately increasing the number and quality of broadband services provided to end-users;
- given the wholesale business model of the passive fibre-optic backhaul network, where a backhaul network operator is not simultaneously present at the retail market, such business model represents a simpler option regarding the operational aspect of the NP-BBI implementation since any negative effect related to the HT's vertical integration (the HT is simultaneously a wholesale operator on passive and active layers as well as a retail operator on a service layer) and its status of an operator with significant market power (SMP) is eliminated;
- also in view of the NP-BBI implementation aspect, the implementation of this project according to the option of upgrading the existing HT's backhaul network applying the private DBO investment model would bring the significant risk related to the justification of the aid amount required by the HT, given the impossibility of ensuring the competitiveness in the operator selection procedure[17] (only the HT, among all other operators on the Croatian market, has the existing backhaul

[17]The competitiveness of the operator selection procedure is required in Articles 78c) and 78d) of the Broadband Guidelines.

network in the majority of targeted settlements where this network can be upgraded according to the requirements of the NP-BBI);

- with respect to the UFOI project, the OiV, as the CAOI and the operator of passive fibre-optic backhaul infrastructure, may have at disposal the free capacities of electronic communications infrastructure owned by public companies on the portion of the existing routes of the UFOI covering the targeted settlements of the NP-BBI, which significantly reduces the NP-BBI investment costs, given the reduction of costs that would be otherwise required for the construction of a new electronic communications infrastructure (primarily cable ducts) to all the targeted settlements of the NP-BBI (see also Chapter 3.4)

Based on the above-described comparative advantages of building the public fibre-optic backhaul infrastructure, this option is selected as the best option of the NP-BBI implementation, and as such, it is analysed in detail and specified in the remaining parts of this document.

1.9 Electronic communications infrastructure

The ECA [10] defines the electronic communications infrastructure and other associated facilities (hereinafter ECI) as "*the infrastructure and facilities associated with an electronic communications network and/or electronic communications service which enable and/or support the provision of services via that network and/or service*" and which "*includes ducts, masts, buildings and other associated facilities and equipment and conditional access systems and electronic program guides*". The most important ECI for implementing this Programme comprises cable duct systems for installing and protecting the backhaul network cables, as well as appropriate spaces equipped with adequate infrastructure for accommodating the passive and active network equipment in network nodes where the backhaul links are terminated, whether such spaces are located in buildings or in outdoor cabinets. Such spaces are usually called *co-location spaces* as they allow a co-location of network equipment of multiple operators as users of the backhaul links. The aim of this Chapter is to provide a concise overview of the situation in the segment of the electronic communications market in Croatia related to the ECI in the backhaul networks.

Cable ducts are basic infrastructural prerequisites for implementing the backhaul networks. The major part of the existing backhaul network in Croatia is built as an underground network using underground cable ducts, while the minor part is built as an overhead network using poles (usually in rural areas). It is an outcome of the historical circumstances regarding the practice of ECI construction in Croatia and the provisions of the spatial (physical) plans that have been valid in the areas through which the particular backhaul links have been planned to pass at the time of the construction of the associated ECI.

The ECA stipulates that an infrastructure operator of cable ducts is any operator using its own or someone else's real property for passing of its cable ducts, or has the right of way

over someone else's real property (this right of way must be confirmed by a certificate issued by HAKOM).

Regardless of the status of an infrastructure operator, given the historical circumstances of construction and management of the backhaul network from the telecommunications monopoly period, the HT manages the majority of cable duct routes spreading within the HT's backhaul network. Recognizing the importance of cable ducts as a basic prerequisite for the development of infrastructural competition between operators on the market, HAKOM issued in 2010 the regulatory decision [39] imposing to the HT the obligation to publish a Reference Offer on access to its infrastructure of cable ducts. This Reference Offer is in force since 2011 [40]. The HT's Reference Offer is also in accordance with the provisions of the relevant Ordinance [12] stipulating the conditions for the shared use of the ECI referring to cable ducts.

Although the above-mentioned HT's Reference Offer provides the prerequisites for a higher level of infrastructural competition between operators also in the sphere of backhaul networks, in practice, it is difficult to make these prerequisites operational through building the alternative backhaul links within the existing cable duct systems owned and/or managed by the HT. The primary reason is that all the relevant technical data about the routes of backhaul links managed by the HT are often not available even to the HT, meaning that the necessary formal and practical condition that should enable access to these cable ducts to other operators is not fulfilled[18]. Furthermore, even if the HT has the necessary data for a particular route, the lack of available space may be the reason that other operators cannot use the required capacity of ducts on this route. In this case, the particular operator and HT can agree, in accordance with the available technical possibilities, to upgrade the capacity of cable duct system on this particular route, but it certainly will further delay and raise the costs of access to cable ducts managed by the HT. The HT may also have inaccurate information about the available capacity on particular routes of cable ducts because some unidentified operators pulled in their cables without permission, which again can delay or prevent the access to these cable ducts.

In addition to the above-mentioned practical difficulties associated with the regulated access to cable ducts managed by the HT, in a wider context, an aggravating circumstance for the construction of an alternative infrastructure of backhaul links is also a lack of a unified register of infrastructure (i.e. the register of installed lines/routes belonging to different infrastructural systems) that would provide easily accessible and complete information about routes and capacities of the entire existing infrastructure of cable ducts at

[18] Describing the process for submission of a request regarding the use of the available capacity of cable ducts on particular routes, the HT's Reference Offer on manner and conditions for access to, and shared use of, cable ducts [40], at page 7, states that the requested data will be provided only for routes "... *where such data is available within the HT's database*".

the national level[19]. This is especially important for backhaul networks, given that they cover the larger geographical areas with a large number of routes.

Besides, it is likely that the existing routes of cable ducts do not cover the entire Croatian territory, particularly the smaller settlements in rural areas.

It can be concluded that the current situation on the part of the ECI market referring to the cable ducts does not ensure simple conditions for the construction of additional backhaul capacities and links within the existing ECI, wherewith any operator could compete in infrastructure with the HT's backhaul network. The main cause of this problem is a lack of the unified register of infrastructure at the national level, through which any operator could get an insight into the routes and the available capacities of the existing ECI. Furthermore, in the part of the ECI referring to the cable ducts managed by the HT and regulated through the HT's Reference Offer on access to cable ducts, a lack of up-to-date data about the available free capacities of cable ducts on all routes managed by the HT can also slow down, hinder or completely disable the alternative operators in laying their additional cables to build their own backhaul links, i.e. it can disable the infrastructural competition with the HT.

[19] The development of a national register of infrastructure is planned within the National Spatial Data Infrastructure (NSDI) [41], but the period in which such a register will be available is not known precisely, although it is likely that its development will last several years.

2 Infrastructural, technological and business aspects of the Programme implementation

This Chapter describes the NP-BBI implementation by defining the infrastructural and technological solutions, as well as the business model for building and managing the NP-BBI broadband infrastructure on the market. In accordance with the introductory remarks, both project units (PU-A and PU-B) are handled jointly, but eventual specific features of each project unit are emphasized where they exist. The defined infrastructural, technological and business solutions are fully compliant with the applicable Croatian legislation for the electronic communications and follow the State aid rules laid down by the Broadband Guidelines.

2.1 Infrastructural and technological solutions

The NP-BBI backhaul network will be carried out by means of optical fibres. The exception to this rule will be possible in sparsely populated and geographically hardly accessible areas of Croatia (mountainous areas and small islands), where backhaul links can be carried out via fixed wireless point-to-point links (hereinafter *directional wireless links*). Such wireless backhaul links will be implemented only in the cases where low demand for capacity per link is expected, and where this solution is economically more efficient than laying fibre-optic cables. The possible targeted areas of the NP-BBI where the backhaul links might be implemented via directional wireless links are listed in Annex (see also Chapter 5.4).

Optical backhaul links will be implemented by means of optical multi-fibre cables dimensioned in accordance with the anticipated demand of targeted users of the backhaul network (all operators on the market) within the project unit PU-A and public institutions located in targeted areas of the Programme implementation within the project unit PU-B. The need for additional capacities for a technical reserve and future capacity increase requests will be also taken into account (a detailed specification of planned capacities for targeted areas of the Programme is given in Annex; see also Chapter 5.3.3). Generally, only the single mode optical fibres conforming to the ITU-T G.652D recommendation will be used. Exceptionally, for connecting the end-users of public administration bodies within the area of access networks for the purposes of the project unit PU-B, also the optical fibres conforming to the ITU-T G.657 recommendation will be used where appropriate.

Fibre optic cables will be installed in underground cable ducts. The existing cable ducts will be used on all the routes where the free cable duct capacities exist and are available. Maximum efforts will be made to exploit the free capacities of the existing ducts within the UFOI, to which, as a contractor for the operational implementation of the UFOI and owing to the contracts with public companies (see Chapter 1.4.3), the OiV has access. On the remaining routes without cable ducts or without available capacities in the existing cable ducts, the new cable duct sections will be built within the Programme. The planning and

construction of new cable duct sections will follow, to the fullest possible extent, the routes and land corridors in the public ownership (corridors of public roads, highways, railways, power transmission lines, etc.). This will facilitate and speed up the procedures for obtaining all the necessary approvals and permits related to the scope of spatial (physical) planning and construction, and required for constructing the new cable duct sections. Exceptionally, an overhead network of aerial fibre-optic cables will be used on particular backhaul network routes in rural areas, but only if a preceding analysis of all relevant technical and economic parameters indicates a significant advantage of implementing this solution in comparison to the solution using underground cable ducts[20].

Any active network equipment, intended for, or adapted to, any transmission technology, will not be installed in the backhaul terminal nodes for the purposes of realising backhaul links within the project unit PU-A. In other words, the business model for the supply of realised backhaul links will be solely based on a *technologically neutral* lease of dark fibres, as it is specified in Chapter 2.3.1. The exceptions will be only the backhaul links realised via directional wireless links, where, due to the nature of implementing such links, it will be necessary to install the appropriate active equipment, i.e. radio-frequency transceivers, in the terminal nodes of these links.

Within the project unit PU-B, in order to connect the public administration bodies, the Programme anticipates the possibility of implementing active network equipment, both on the location of the end-user and in the backhaul network nodes of the NP-BBI, for switching and/or routing the network traffic between the locations of the public administration bodies and the core network, as well as interconnecting the public administration bodies. At the same time, the Programme leaves the possibility that the end-users within the implementation scope of the project unit PU-B are connected only with dark fibres (i.e. without implementing any active network equipment) allowing the end-users the possibility of implementing an appropriate active network layer independently. The precise specification of modalities of connecting the public bodies as end-users within the project unit PU-B will be defined according to the needs of each individual public user during the preparation of the Programme implementation.

Within the backhaul link nodes, the Programme will implement the spaces equipped with adequate infrastructure (the so-called *co-location spaces*), allowing, for all the operators within the project unit PU-A, the physical access to the backhaul network and installation of proprietary passive and active network equipment for implementing the active backhaul links. Each co-location space will be equipped with appropriate optical distribution frames allowing flexible access and cross-connecting of individual optical fibres installed within the backhaul network. In addition, each co-location space will be equipped with power supply and air conditioning systems in order to enable the accommodation and undisturbed operation of the active network equipment installed in this co-location space. The precise micro-location of each node, i.e. each associated co-location space, within the

[20] The technical parameter that should be considered is also the sensitivity of the overhead/aerial network to atmospheric influences (wind, ice) and consequently the shorter life-span in relation to the underground network of cable ducts.

targeted settlements of the Programme will be determined subsequently in the course of preparing the particular Programme phase. Maximum efforts will be made in determining the micro-locations of co-location spaces within the targeted settlements in such a way that these co-location spaces are indoor spaces of publicly owned buildings, including the buildings accommodating the end-users of public administration bodies that will be connected within the project unit PU-B (e.g. educational institutions, state administration bodies' offices, medical institutions, etc.). In addition, efforts will be made in determining the micro-locations of co-location spaces in such a way that co-location spaces are in the settlement centres, in order to achieve the optimal technical prerequisites for the coverage of all end-users in NGA networks that will be implemented within the Framework Programme. In this respect, it is necessary that micro-locations of co-location spaces coincide with or are close to the optical *distribution hubs* (hereinafter DH) or *metropolitan points of presence* (hereinafter MPoP)[21] in the case of implementing FTTH access networks, as well as coincide with or are close to the access network central offices in the case of access networks applying the technological solutions partially or fully relying on the existing infrastructure of copper twisted pairs.

During the preparation of each phase of the Programme, the CAP and the CAOI (i.e. OiV) will jointly take into account the selection of optimal micro-locations for co-location spaces, in accordance with the development of NGA networks in each targeted settlements as well as the implementation dynamics of individual projects of NGA network roll-outs within the Framework Programme.

For clarity, it is necessary to mention that in certain cases within the project unit PU-B the Programme will also include the implementation of individual connections to public administration bodies as end-users in access networks. This will be the case when the micro-location of co-location space in the particular targeted settlement will not coincide with the locations of all public administration bodies in this settlement (i.e. when public users in the particular targeted settlement are located on several micro-locations). Such interventions within the access network domain will be aimed only at the end-users of public administration bodies within the project unit PU-B (see Chapter 3.1.1), that is, the Programme will not cover any kind of infrastructure connections to other end-users in access networks (e.g. residential and business end-users) that are not specified within the project unit PU-B.

In general, a precise specification of the relevant infrastructural and technological solutions for each individual route and node of the backhaul network within the NP-BBI will be carried out during the preparatory activities for each phase of the Programme.

An overview of the relevant technical provisions of the bylaws within the ECA framework that have an impact on the Programme implementation is given below.

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[21] In accordance with the *Ordinance on optical fibre distribution networks* [42], the DH is a concentration point of cables from the distribution part of the optical access network (i.e. optical fibre distribution network), while the MPoP is access network operator's node aggregating the traffic from one or more DHs into higher level networks (e.g. core network).

2.1.1 Regulation on the criteria for the development of electronic communications infrastructure and other associated facilities

This Regulation [11] lays down the general principles and criteria for ECI planning and constructing from the aspect of preparing and implementing the spatial (physical) planning documents. Planning and constructing the cable duct routes are most significant for implementing this Programme. In this regard, the Regulation anticipates also applying a *principle of integrated construction*, implying coordinated planning and constructing of ECI and utility infrastructure within the utility infrastructure corridors or routes, and coordinating the construction deadlines of the ECI and utility infrastructure.

The OiV, as the CAOI and an infrastructure operator, must be involved in drafting and implementing the spatial (physical) plans of counties, towns and municipalities in all targeted areas of the Programme, ensuring the submission of OiV's plans related to the ECI construction in time. In order to reduce the total investment cost and depending on the practical possibilities and timelines of the OiV and other companies that are in majority public ownership, the new routes of the ECI within the scope of the NP-BBI will be built within the corridors of public transport and energetic systems and simultaneously with reconstructing the existing or constructing the new routes or sections of these systems, in whatever cases it would be practically feasible.

2.1.2 Ordinance on technical requirements for cable ducts

This Ordinance [13] defines the technical requirements for developing, planning, designing, building and maintaining cable ducts, and must be applied in all the cases where the NP-BBI backhaul links will be realised using cable ducts. The planned minimum capacities of cable duct systems that will be built on NP-BBI backhaul link routes must be also harmonized with the provisions of this Ordinance, where the provisions related to the cable duct routes planned along the local and county roads, as well as along the inter-county and main roads, are particularly relevant.

2.1.3 Ordinance on manner and conditions of access to, and shared use of, electronic communications infrastructure and other associated facilities

This Ordinance [12] lays down the modalities for access to, and shared use of, the ECI and other associated facilities, in a part related to cable ducts, poles, antenna masts, buildings and other associated equipment and facilities. This Ordinance is important for implementing this Programme in the part related to the access to existing infrastructure for the purpose of building the backhaul links, as well as in the part related to the obligations of the OiV, as the infrastructure operator in the Programme, to provide all other operators on the market with the open access to the free capacities of newly built cable ducts. These obligations of enabling access to, and sharing of, the ECI to other operators will also apply to antenna masts (for backhaul routes via directional wireless links) and to all newly built and adequately equipped co-location spaces in the backhaul network nodes (see also Chapter 3.5.2 describing the mandatory wholesale services).

2.1.4 Ordinance on optical fibre distribution networks

This Ordinance [42] lays down the technical provisions for planning, building, using and maintaining optical fibre distribution networks, as terminal segments of FTTH access networks between end-users and fibre distribution hubs (see also footnote 21). For the avoidance of doubt, it is necessary to point out that the provisions of this Ordinance shall not apply to the backhaul networks covered by this Programme and carried out via optical fibres (regardless of whether they are, in the terminology of this Ordinance, considered as parts of *feeding* or *core* networks). In addition, it is necessary to point out that this Ordinance does not cover the fibre-optic links that will be created within the access networks for connecting the users of public authorities within the project unit PU-B, since these links are dedicated to the specific public end-users only and therefore do not have the characteristics of access networks with wider coverage of end-users[22].

2.2 Investment model of the Programme implementation

The responsibility for the operational implementation of this Programme, including both project units (building the backhaul network - PU-A and connecting the end-users of public administration bodies - PU B), will be entrusted to the public company "Transmitters and Communications Ltd." (OiV).

The OiV is a public company wholly owned by the Republic of Croatia. The OiV's subject of business includes the activities within the electronic communications sector.

In accordance with the Companies Act and Articles of Association, the OiV has an Assembly, a Supervisory Board, and a Company Board. The Assembly (Croatian Government, represented by the Minister of Maritime Affairs, Transport and Infrastructure) recalls and appoints the Supervisory Board. The fundamental competence of the Supervisory Board is the permanent monitoring of OiV's operational management of business activities as well as the appointments of Board members. The Company Board is authorized to manage the company's business activities and to represent the company. Among other things, the Company Board is responsible for, and authorized to take, all the actions and to make all the decisions it deems to be necessary for the successful management of OiV's business activities, including the decision-making to achieve the business strategy, plans and work and development programs. One of the important business activities of the OiV is the terrestrial broadcasting of radio and television programs via networked transmitters covering the entire Croatian territory. With the transition from analogue to digital terrestrial television broadcasting using the DVB-T standard, the OiV became an operator of a digital terrestrial television network (multiplex) at national, sub-regional, and local levels.

[22] This is confirmed by HAKOM during the Ordinance notification procedure in the bodies of the European Commission [43]; in response to the request for information referring to the draft of this measure, HAKOM stated that *this measure does not apply to the leased optical fibres placed on an ad hoc basis for specific users and not providing wide coverage of a part of territory or a local network.*

The CAP, as the holder of the State aid programme, will perform the supervision and coordination of the implementation of the entire Programme (see also Chapter 1.5).

Given the defined Competent Authority for the operational implementation of the Programme (CAOI) - the public company OiV, this Programme will be carried out using a *public design, build and operate* (i.e. *public DBO*) investment model, in accordance with the former practice of implementing the projects of subsidised construction of broadband infrastructure in the EU [38], [44][23]. The decision to select the public DBO investment model is motivated by the need to maintain the full public control over the entire implementation of the Programme, which includes planning, constructing, operational managing and maintaining the backhaul network within the NP-BBI. The backhaul network of the NP-BBI is a very important technical and economic resource ensuring the availability of NGA broadband for end-users on the entire territory of Croatia and a prerequisite for the successful implementation of the related State aid Programme aimed at NGA networks (Framework Programme).

The decisions on the investment model and the CAOI are also motivated by the fact that the project unit PU-B is aimed at connecting the public users in targeted areas of the Programme to the NGA broadband infrastructure. Thus, the project unit PU-B will be undertaken for the self-provision purposes of the public administration bodies that does not perform economic activities, which is not regarded as State aid (see also Chapter 1.5). Since the project units PU-B and PU-A, for the most part make a unique infrastructural project, it is a reasonable decision to implement both project units within a unique Programme, including the appointment of a unique Competent Authority for the operational implementation of the Programme (CAOI) and the operational management of the infrastructure built within the Programme. Furthermore, this approach also contributes to a significant reduction of investment costs in relation to the investment costs that would be required in the case of implementing both project units through separate programmes or projects.

The OiV will own the entire newly constructed infrastructure within the Programme. Having the operational responsibility for the Programme implementation, the OiV will procure, where necessary for certain activities related to planning, building, managing and maintaining the built infrastructure, also other companies, taking into account the assurance of all administrative and technical capacities required for the effective and timely Programme implementation. All associated procurement procedures will be performed as transparent public procurement procedures in accordance with the Public Procurement Act [20] (see also Chapter 3.3). It is important to emphasize also that, regardless of the involvement of other companies, the OiV always will be a holder of responsibility for all network management activities, including also collecting the fees for utilising the infrastructure built within the Programme[24].

[23] For comparison, a public DBO investment model is within the Framework Programme marked as "Model B".
[24] Any deviation from this rule would lead to detachment from the public investment DBO model.

Furthermore, taking into account other activities of the OiV as a public company, which are outside the scope of this Programme (e.g. managing digital terrestrial television networks, placing existing infrastructure of the UFOI on the market, etc.), and following the provisions of the Broadband Guidelines and former EU practice in approval of similar projects involving State aid, the OiV will apply *accounting separation* for all activities related to the implementation of this Programme, in order to achieve the highest possible level of transparency in the spending of the public funds and State aid. In view of implementing the project through two project units, where the project unit PU-B does not involve State aid, the accounting separation will be further implemented at a lower level within the Programme itself, to separate the activities within the project units PU-A from the activities within the project unit PU-B (see also the analysis of the framework business plan of the Programme in Chapter 4.4.1).

The OiV's business activities related to the collection of fees from leasing the capacity of backhaul links within the project unit PU-A will be based solely on a non-profit basis, with the aim that the revenues from fees covers all operating costs of managing and maintaining the NP-BBI backhaul links. All extra-revenues (and the eventual profit) realised within the project unit PU-A will be directed into expanding the existing or building the new capacities within the justified areas defined by this Programme (see also Chapter 3.6).

2.3 Business model of the Programme implementation

The term *business model* refers in principle to a market-oriented model of the business activities that the OiV performs as the infrastructure operator of the backhaul network deployed within the project unit PU-A of this Programme. In order to achieve the transparency of the Programme implementation, the business model for the OiV's activities within the project unit PU-B related to connecting the users of public administration bodies to NGA networks is also separately defined.

2.3.1 Business model within the project unit PU-A

The OiV will manage the newly built backhaul network in targeted areas exclusively according to the wholesale business model. It is a model of an open network whose capacities will be leased to all the operators on the electronic communications market for the purposes of connecting the parts of their own networks enabling the access to the nodes and end-users in the access network. The OiV will not be active in the retail market and will not provide end-users with the retail services. The exceptions are only the end-users of public administration bodies covered by the project unit PU-B, which is described in detail in Chapter 2.3.2.

Due to the infrastructural and technological solutions implemented within the project unit PU-A, as it is described in Chapter 2.1, the OiV's wholesale services will be mostly based on a dark fibre lease. This form of wholesale services on a passive infrastructural level has a technologically neutral character, since it allows operators to deploy their own technological

solutions with the necessary capacity on an active network layer. In addition, it contributes to the development of infrastructural competition between operators, since the operators implementing their own technological solutions and nodes on the active network layer will have an opportunity to build and customize their own networks to the needs of end-users and services provided. In this way, the selected business model and the entire Programme have exceptionally pro-competitive characteristics and can significantly contribute to the further liberalisation of the electronic communications market in Croatia.

In addition to the wholesale services of leasing dark fibres, on the parts of the backhaul link routes with the newly built cable duct infrastructure that will be managed by the OiV, the OiV will also offer the wholesale services of leasing free space in cable ducts.

In the cases of backhaul links realised via directional wireless links, because of a technological nature of such connections, the wholesale services will be based on leasing guaranteed symmetrical transmission capacity. In comparison to the backhaul links realised via optical fibres, the backhaul links realised via directional wireless links will represent a significantly smaller share of backhaul links in the Programme (see Chapter 5.4 and Annex).

In addition to the above-mentioned wholesale services, in the backhaul network nodes within the scope of this Programme the OiV will also offer the co-location services for operators' passive and active network equipment, in order to allow the operators access to, and use of, the backhaul network capacities.

The wholesale services stipulated within the Programme are described in detail in Chapter 3.5.2.

2.3.2 Business model within the project unit PU-B

Depending on the needs and preferences of the end-users within the project unit PU-B, where the corresponding details will be determined directly in the course of preparing the Programme implementation, the OiV will be authorised to provide the services of connecting the public users to the NGA network only on a passive layer or also on an active layer, where the latter implies also installing the appropriate active network equipment within the end-user's premises as well as within the relevant network nodes of the NP-BBI. This active network equipment will not be used for providing the wholesale services within the project unit PU-A, in accordance with the above-described business model for the project unit PU-A.

3 Structural rules of the Programme

This chapter defines in detail all the structural rules of the Programme as the provisions of the Broadband Guidelines applied to this Programme. The Programme implementation must consistently comply with these structural rules. These structural rules are related mainly to the project unit PU-A and include:

- defining the justified areas of the Programme and targeted users of the public administration bodies within the project unit PU-B (in order that PU-B would not include State aid), in accordance with the provisions of Articles 78a) and 11) of the Broadband Guidelines - Chapter 3.1;
- conducting the public consultation on the Programme and verifying the justified areas of the Programme implementation, in accordance with the provisions of Article 78b) of the Broadband Guidelines - Chapter 3.2;
- implementing public procurement procedures, in accordance with the provisions of Articles 78c) and 78d) of the Broadband Guidelines - Chapter 3.3;
- utilising the existing infrastructure, in accordance with the provisions of Article 78f) of the Broadband Guidelines - Chapter 3.4;
- defining the wholesale services, including the prices and conditions for providing the wholesale services, in accordance with the provisions of Articles 78g) and 78h) of the Broadband Guidelines - Chapter 3.5;
- defining the procedure for refunding the excessive aid (*clawback*), in accordance with the provisions of Article 78i) of the Broadband Guidelines - Chapter 3.6;
- defining the obligations regarding the transparency of implementation and reporting on the implementation of the Programme, in accordance with the provisions of Articles 78j) and 78k) of the Broadband Guidelines - Chapter 3.7.

It is also necessary to point out that the structural rules of the Programme also cover the obligations of implementing the Programme in accordance with the public DBO investment model, including also the obligation of accounting separation of the project unit PU-A, as well as the obligation of applying the wholesale business model of an open network, as it is described in Chapters 2.2 and 2.3.1.

3.1 Justified areas of the Programme implementation

This Chapter explains the rules for determining the areas justified for implementing the Programme in view of the backhaul infrastructure roll-out within the project unit PU-A. The end-users of public authorities that will be connected to the ultra-fast NGA infrastructure within the project unit PU-B, and spatially are located within the justified targeted areas defined by the project unit PU-A, are also determined in this Chapter.

In the course of determining the areas justified for the Programme intervention related to the project unit PU-A, the availability of broadband infrastructure and services in access networks, as well as the availability of infrastructure and services of backhaul links connecting the respective access network within the particular targeted settlement, are simultaneously taken into account in accordance with the provisions of the Broadband Guidelines (especially of Article 61) and the former implementation practice for similar projects fostering the roll-out of backhaul networks in EU countries[25]. With regard to the above-mentioned availability of infrastructure and services, the justified areas are categorised using the colours in accordance with the provisions of the Broadband Guidelines (i.e. white, grey and black areas). This categorisation (mapping) is carried out at the level of settlements as the smallest demographic units of the population.

The rules of the Framework Programme [24] are used to determine the settlement colour regarding the availability of broadband access infrastructure, where the colour of each settlement is updated in accordance with the recent data on the availability of basic broadband access and the NGA given in the HAKOM's OBC, as well as in accordance with the operators' data on status of, and plans for, their investments in NGA networks that was collected during the public consultation on the Programme. Each settlement is categorised in a way that the assigned NGA colour must match the availability of NGA broadband infrastructure to at least 90% of the of the settlement population[26].

The state of the existing backhaul networks in targeted settlements of the NP-BBI is determined according to the operators' comments collected during the public consultation, including also the comments of the HT (see also Chapter 1.8.1). In all targeted settlements where there is no adequate NGN backhaul networks capable of providing the capacity needs in line with the analysis of the backhaul capacity carried out in Chapter 1.7.1, the unsatisfactory state of the NGN backhaul is declared, having a direct impact on determining the settlement colour with regard to the availability of backhaul networks, as it is described in detail below. Besides information regarding the current state of the existing operators' backhaul networks, also the plans for operators' independent investments in NGN backhauls within the next three years were requested in the course of the public consultation. In this respect, all credible investment plans in targeted settlements of the NP-BBI in the next three years are taken into account when determining the colours of targeted areas in accordance with the rules of the Broadband Guidelines.

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[25] For instance *Optical fibre Catalonia (Xarxa Oberta) – N 407/2009*, *Broadband network project in Eastern Poland - SA.33438 (2011/N), SA.33440 (2011/N), SA.33441 (2011/N), SA.33439 (2011/N), SA 30851 (2011/N)*.

[26] For example, if the OBC shows the availability of single NGA infrastructure for 50% of the settlement population, this settlement is marked as "NGA white" (B_{nga}). The limit of 90% is determined in line with the reasonable assumption that in practice is mostly difficult to achieve the population coverage of NGA broadband infrastructure equal to 100% for individual settlement, especially in the case of only one type of NGA infrastructure in rural and spatially dispersed settlements. The NGA colour assigned to the individual settlement in this Programme does not imply also the justification of the Framework Programme intervention for the entire area of this settlement but only for the part of the settlement population that is not adequately covered with NGA infrastructure (e.g. if NGA infrastructure is available for 70% of the population of the settlement marked as B_{nga} , the intervention within the Framework Programme can be justified at least for the remaining 30% of the population to which the NGA infrastructure is not available).

For clarity, all the designations of area colours related to this Programme will contain index "b" (emanating from *backhaul*) in order to distinguish them from other designations of area colours related to the access networks within the Framework Programme (index "osn" for the basic access or "nga" for the NGA).

In particular, the rules for determining the colours of targeted settlements in this Programme include the following combinations of the availability of infrastructure and services in NGA networks and the availability of infrastructure and services of the backhaul links to these access networks, thus determining the justification of intervention of this Programme in individual settlements (see Table 3-1):

a. the settlements where NGA broadband is unavailable for at least 10% of the settlement population and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years (NGA white settlements - B_{nga}), as well as the settlements where only one NGA broadband infrastructure is available to at least 90% of the settlement population, but without any offer of retail NGA services and without plans for investing in the NGA broadband infrastructure realising the full population coverage of the settlement in the next three years (problematic NGA grey settlements - $S1_{nga}$); and simultaneously the settlements where the NGN backhaul is not available and there are no plans for building the NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as white regarding the justification of intervention by this Programme (B_b);

b. the settlements where NGA broadband is unavailable for at least 10% of the settlement population and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years (NGA white settlements - B_{nga}), as well as the settlements where only one NGA broadband infrastructure is available to at least 90% of the settlement population, but without any offer of retail NGA services and without plans for investing in the NGA broadband infrastructure realising the full population coverage of the settlement in the next three years (problematic NGA grey settlements - $S1_{nga}$); and simultaneously the settlements where one NGN backhaul is available or there are plans for building one NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as grey regarding the justification of intervention by this Programme (S_b);

c. the settlements where NGA broadband is unavailable for at least 10% of the settlement population and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years (NGA white settlements - B_{nga}), as well as the settlements where only one NGA broadband infrastructure is available to at least 90% of the settlement population, but without any offer of retail NGA services and without

plans for investing in the NGA broadband infrastructure realising the full population coverage of the settlement in the next three years (problematic NGA grey settlements - $S1_{nga}$); and simultaneously the settlements where at least two NGN backhauls of different operators are available or there are plans for building at least two NGN backhauls of different operators in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as black regarding the justification of intervention by this Programme (C_b);

d. the settlements where only one NGA broadband infrastructure is available for at least 90% of the settlement population, including also the offering of retail NGA services, and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years, as well as the settlements without the NGA broadband infrastructure covering at least 90% of the settlement population, but where there are plans for investing in the NGA broadband infrastructure realising the full population coverage of the settlement in the next three years (non-problematic NGA grey settlements - $S2_{nga}$); and simultaneously the settlements where the NGN backhaul is not available and there are no plans for building the NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as white regarding the justification of intervention by this Programme (B_b);

e. the settlements where only one NGA broadband infrastructure is available for at least 90% of the settlement population, including also the offering of retail NGA services, and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years, as well as the settlements without the NGA broadband infrastructure covering at least 90% of the settlement population, but where there are plans for investing in the NGA broadband infrastructure realising the full population coverage of the settlement in the next three years (non-problematic NGA grey settlements - $S2_{nga}$); and simultaneously the settlements where one NGN backhaul is available or there are plans for building one NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as grey regarding the justification of intervention by this Programme (S_b);

f. settlements where only one NGA broadband infrastructure is available for at least 90% of the settlement population, including the offering of retail NGA services, and there are no plans for building the NGA broadband infrastructure realising the full population coverage of the settlement in the period of the next three years, as well as the settlements without the NGA broadband infrastructure covering at least 90% of the settlement population, but where there are plans for investing in the NGA broadband infrastructure realising the full population coverage of the

settlement in the next three years (non-problematic NGA grey settlements - $S2_{nga}$); and simultaneously the settlements where at least two NGN backhauls of different operators are available or there are plans for building at least two NGN backhauls of different operators in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as black regarding the justification of intervention by this Programme (C_b);

g. the settlements where at least two NGA broadband infrastructures of different operators, both of them covering at least 90% of the settlement population, are available, as well as the settlements where, according to the investment plans, in the next three years at least two NGA broadband infrastructures of different operators, both of them realising the full population coverage of the settlement, will be available (NGA black settlements - C_{nga}); and simultaneously the settlements where the NGN backhaul is not available and there are no plans for building the NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as grey regarding the justification of intervention by this Programme (S_b);

h. the settlements where at least two NGA broadband infrastructures of different operators, both of them covering at least 90% of the settlement population, are available, as well as the settlements where, according to the investment plans, in the next three years at least two NGA broadband infrastructures of different operators, both of them realising the full population coverage of the settlement, will be available (NGA black settlements - C_{nga}); and simultaneously the settlements where one NGN backhaul is available or there are plans for building one NGN backhaul in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as grey regarding the justification of intervention by this Programme (S_b);

i. the settlements where at least two NGA broadband infrastructures of different operators, both of them covering at least 90% of the settlement population, are available, as well as the settlements where, according to the investment plans, in the next three years at least two NGA broadband infrastructures of different operators, both of them realising the full population coverage of the settlement, will be available (NGA black settlements - C_{nga}); and simultaneously the settlements where at least two NGN backhauls of different operators are available or there are plans for building at least two NGN backhauls of different operators in the next three years, all in accordance with the NGN backhaul capacity needs resulting from the analysis carried out in Chapter 1.7.1, are marked as black regarding the justification of intervention by this Programme (C_b).

Table 3-1 – General rules for determining the settlement colours in the Programme

Settlement colour regarding the NGA availability[1]	Availability of NGN backhaul[2]	Settlement colour in this Programme	Rule described in text
B_{nga}, $S1_{nga}$	unavailable	B_b	*a*
	available (one backhaul)	S_b	*b*
	available (at least two backhauls)	C_b	*c*
$S2_{nga}$	unavailable	B_b	*d*
	available (one backhaul)	S_b	*e*
	available (at least two backhauls)	C_b	*f*
C_{nga}	unavailable	S_b	*g*
	available (one backhaul)	S_b	*h*
	available (at least two backhauls)	C_b	*i*

[1] In accordance with the categorisation of the Framework Programme and recent data from the HAKOM's OBC.
[2] It assumes the anticipated capacities in line with the analysis carried out in Chapter 1.7.1, including also the operators' plans for investing in such networks, in accordance with the rules of the Broadband Guidelines.

It is also important to point out that the availability of the adequate NGN backhaul requires that the relevant backhaul network node is located within the inhabited part of the settlement (which is narrower area than the geo-administrative coverage of the settlement). Since infrastructural and technological implementation of NGA networks in targeted settlements will mainly depend on the implementation of projects within the Framework Programme, this Programme requires that the relevant backhaul network node is located within the inhabited part of the settlement. The implementations of the Framework Programme and the NP-BBI will be coordinated by the same body (CAP), thus realising the preconditions for determining the precise micro-locations of backhaul network nodes within the NP-BBI, i.e. the demarcation points between the access and backhaul network (see also the Framework Programme [24]). Coordinated implementation of projects within the Framework Programme and the NP-BBI can also optimize the required number of backhaul network nodes within the NP-BBI, because in areas of higher population density and higher concentration of nearby settlements it is possible to establish a single backhaul node of the NP-BBI covering several neighbouring settlements[27].

The targeted settlements justified for implementing this Programme are all settlements identified as white (B_b), i.e. implementing the NGN backhaul links to these settlements will be allowed within the Programme. A starting node, located in the settlement where the core transmission networks and nodes of multiple operators are available, will be provided for each such link. In this way, each operator, as a user of the NP-BBI network, will have the possibility to connect its own existing network to the new backhaul network capacities built to reach the justified areas of the Programme implementation. Such nodes will be hereinafter referred to as the *transitional nodes*. The locations of transitional nodes are specified in Chapter 5.3.1.

[27] Such population concentration is particularly typical for the central continental parts of Croatia.

Annex contains a detailed list of targeted settlements within the Programme, amended after the closure of the public consultation on the Programme. The associated categorisation of targeted settlements by colours in view of the availability of basic broadband access and NGA broadband in these settlements (mapping) is also given in Annex.

3.1.1 Targeted users within the project unit PU-B

The targeted users within the project unit PU-B are all the public administration bodies that provide the public services and are under the jurisdiction of the public authorities. In addition, in accordance with the State aid rules, it is important that targeted users covered by the project unit PU-B do not perform economic activities, in order that the project unit PU-B would not involve State aid.

Table 3-2 provides a list of targeted users of public administration bodies within the project unit PU-B, structured by groups of public users in line with the jurisdiction of a particular ministry of the Government of the Republic of Croatia. An overview of the number of targeted users per settlements in Croatia is given in Annex.

Table 3-2 – List of targeted users of public administration bodies within the project unit PU-B

Group of users	Public administration bodies
State administration (Ministry of Public Administration [45],[46])	Ministries
	State offices
	State administration organizations
	State administration offices in counties
	Registry offices
	County (regional) public authorities (counties)
	Public authorities at local level (cities/towns and municipalities)
Educational and Scientific Institutions (Ministry of Science, Education and Sports [47])	Primary schools
	Secondary schools
	Higher education institutions
	Scientific institutes
	Technology and research and development centres
Health institutions (Ministry of Health [48])	University hospital centres
	University hospitals
	Clinics
	General hospitals
	Special hospitals
	Health resorts
	Health centres
	Institutes
Financial institutions (Ministry of Finance [49],[50])	Tax Administration
	Customs Administration

Group of users	Public administration bodies
Maritime transport (Ministry of Maritime Affairs, Transport and Infrastructure [51],[52])	Port authorities
	Harbourmasters' offices
Courts (Ministry of Justice [53])	Supreme court
	County courts
	Municipal courts
	Commercial courts
	Administrative courts
	Misdemeanour courts
	County state attorney's offices
	Municipal state attorney's offices
Pension system and employment system (Ministry of Labour and Pension System [54],[55])	Regional Offices of the Croatian Pension Insurance Institute (HZMO)
	Regional offices of the Croatian Employment Service (HZZ)
Police (Ministry of the Interior)	Police stations
Social Welfare (Ministry of Social Welfare Policy and Youth [56])	Social welfare centres
State Geodetic Administration [57]	Central office for cadastre
	Regional offices for cadastre

3.2 Public consultation and verification of the justified areas of the Programme implementation

In order to align the preparation and implementation of this Programme with the provisions of the Broadband Guidelines (especially Article 78b), two public consultation procedures must be conducted as follows:

- *the first public consultation procedure*: upon completing the first version of the Programme and before initiating the pre-notification and notification of the Programme to the European Commission in order to obtain the approval of compliance with the State aid rules (NOTE: the first public consultation procedure was conducted from 8 July 2014 to 30 September 2014);
- *the second public consultation procedure*: just before starting the second phase of the Programme during 2017.

Through the first public consultation procedure the objections and comments from the market participants were collected, with a view to introduce the relevant amendments and changes to the first version of the Programme before initiating the pre-notification and notification procedures in the European Commission bodies. In addition, through the first public consultation procedure, the list of targeted areas of the Programme was verified (see

Chapter 3.1 and Annex) and the operators' plans for investing in access infrastructure and NGN backhaul infrastructure in the next three years were collected.

The basic questions for operators used in the first public consultation procedure are given in Chapter 5.5.

Because the second phase of the Programme will be carried out in the period 2018-2022, which is a significant time lag in relation to the first public consultation procedure that was conducted during 2014, also the second public consultation procedure will be carried out before starting the implementation of the second phase of the Programme, i.e. during 2017. This will subsequently determine the possible changes regarding the availability of NGA broadband infrastructure and NGN backhaul infrastructure (due to the new investments taken in the meantime, or planned to be taken, by the operators on the market), leading, in the second phase of the Programme, to the eventual redefinition of the targeted areas that were defined before the implementation of the first phase.

To ensure the highest possible level of transparency of the Programme preparation and implementation, all the relevant information and documents related to the public consultation procedures will be publicly announced on the website of the CAP and Ministry of Maritime Affairs, Transport and Infrastructure (hereinafter MMATI). In addition, the notifications on launching the public consultation on the Programme will be directly submitted to the operators on the market. Public consultation procedures will be open for at least 45 days, in order to leave to all the participants in the public consultation enough time for a quality analysis of all relevant aspects of the Programme and quality preparation of the required response. The MMATI will take care that all confidential data, or data that operators declared as confidential, particularly regarding the existing condition of, and planned investments in, access and backhaul infrastructure, is not publicly announced, but is used exclusively within the MMATI for the purposes of verifying the justified areas of the Programme implementation.

3.3 Implementation of public procurement procedures

Given the application of the public DBO investment model in the Programme, where the company OiV is responsible for the operational implementation of the Programme, the public procurement procedures will be implemented in all the cases when the OiV will engage the external providers of services, works or goods for the activities related to the Programme. These activities will include the services in the preparatory stages of the project (e.g. preparing the project documentation and obtaining the necessary permits and approvals) as well as in the course of constructing the network (e.g. delivering the necessary equipment and accessories, as well as civil engineering, installation and other works). These activities may also include the services and works related to the operational management and maintenance of the network (e.g. connecting the users, regular and emergency maintenance of networks, etc.).

In all cases of procuring the external services, works or equipment, the OiV must comply with all the relevant public procurement regulations laid down by the PPA [20] as well as the rules on implementing the procurement procedures for projects co-financed by the ESI funds. Depending on the specific needs of a particular public procurement procedure, the OiV will independently establish the criteria for selecting the best offer, including the possibility of applying the criterion of economically most advantageous offer. All relevant information in the course of implementing the public procurement procedures, including the notifications on initiating the procurement procedures, will be published in the Electronic Public Procurement Classifieds of the Republic of Croatia (EPPC) [22], as well as on the OiV's and CAP's websites, in order to ensure the highest possible level of transparency of the Programme implementation. All public procurements with an estimated value exceeding EUR 200,000 (in HRK counter-value) will be announced at the EU level in the Supplement to the Official Journal of the EU [23].

3.4 Utilisation of existing infrastructure

In order to reduce the costs of the Programme implementation, the possibility of using the existing electronic communications infrastructure (ECI) in parts that can serve the needs of the Programme implementation will be analysed in the course of preparing each Programme phase. This is related mostly to the existing infrastructure of cable ducts on the segments of routes where there is free space for laying the fibre-optic cables having the capacity required by the Programme. Given the availability of existing cable duct systems on the Croatian market, the OiV will primarily rely on the free capacities of cable ducts owned by public companies, including also such capacities within the UFOI[28], as well as on the free capacities of cable ducts managed by the HT.

For the backhaul links that will be carried out via directional wireless links, the possibility of using the existing infrastructure of antenna masts, including primarily the antenna masts owned by the OiV, will be analysed too.

In addition, in order to optimize the costs, for the segments of the backhaul link routes passing through the settlements and for all the connections to end-users in the access network within the project unit PU-B, the possibility of using the existing infrastructure of cable ducts within these settlements will be considered.

3.4.1 Application of the principle of integrated infrastructure construction

Given that for the time period anticipated for implementing the Programme also the significant investments in the core transport infrastructure of roads and railways, as well as in the utility infrastructure of water supply and sewerage networks for the whole Croatia, are anticipated, and that these investments will be also partly co-financed by the ESI funds

[28] Due to the need for accounting separation of activities within the project unit PU-A from all other activities of the OiV, including also the activities on the marketing of existing infrastructure of the UFOI, the costs of fees for using the existing infrastructure of the UFOI must be transparently presented as an expenditure within the project unit PU-A.

within the other OPCC's investment priorities, the maximum care will be taken in the course of preparing the Programme to allow for the spatial and temporal coordination of the Programme implementation with the implementations of other projects building basic transportation and utility infrastructure, i.e. the possibility of applying the principle of integrated infrastructure construction (see Chapter 2.1.1) will be considered. In this way it is possible to achieve the reduction of investment costs related to the construction of backhaul infrastructure, mainly in the portion related to the construction works (e.g. excavation works for cable duct routes), since this part of the Programme costs could be completely eliminated or shared with the coordinated projects for the construction of transport and utility infrastructure. In this respect, besides the OiV, also the CAP and the management bodies of the OPCC will be involved in all activities related to the coordination of these projects.

3.5 Wholesale access to backhaul infrastructure

In accordance with the provisions of Articles 78g) and 78h) of the Broadband Guidelines, this Chapter describes the rules for providing the wholesale services on the backhaul infrastructure built within the Programme. These rules are the structural rules of the Programme and must be strictly followed by the OiV as a holder of the operational implementation of the Programme (CAOI). For the avoidance of doubt, the specified wholesale obligations are related exclusively to the backhaul infrastructure built within the project unit PU-A, and are not related to connecting the end-users of public administration bodies realised within the project unit PU-B.

3.5.1 Conditional access

In order to achieve, through the built backhaul infrastructure, a significant step forward in terms of availability and speeds of broadband (the so-called *step change* in accordance with the Article 51 of the Broadband Guidelines), and to make that this step is related also to the access networks, including the access networks built within the Framework Programme, the Programme introduces a principle of *conditional access* to the backhaul infrastructure of the NP-BBI.

The conditional access is stipulated by the following rules of using the NP-BBI backhaul infrastructure (see Table 3-3):

i) in targeted settlements that are white with regard to the basic broadband access (B_{osn}), the access to, and use of, the NP-BBI backhaul infrastructure is allowed to the operators from all access networks, regardless of whether these operators within these networks provide the basic or NGA broadband;

ii) in all other targeted settlements, the access to, and use of, the NP-BBI backhaul infrastructure is allowed only to the operators from NGA networks, i.e. from the networks in which these operators provide the broadband access with download speeds of at least 30 Mbit/s.

Table 3-3 – Rules for conditional access to the NP-BBI backhaul infrastructure

Rule	Settlement colour with respect to the basic access	Access networks that may be connected to the NP-BBI backhaul infrastructure	Note
i)	B_{osn}	Basic access and NGA networks	Minimum download speeds in access networks must be 2 Mbit/s.
ii)	S_{osn}, C_{osn}	Only NGA networks	Solely NGA networks with download speeds equal to, or greater than, 30 Mbit/s.

Within the settlements that are white with regard to the basic access (B_{osn}), the first rule of conditional access to the NP-BBI backhaul infrastructure exceptionally allows also the connection of traditional broadband access networks in order to foster the general development of the broadband access in these areas (currently without broadband at all) through bringing the necessary NP-BBI backhaul infrastructure.

The above-mentioned principles of conditional access are also a part of the structural rules of the Programme in the area of wholesale access to the NP-BBI backhaul infrastructure, and must be fully followed for all the kinds of wholesale services described in the next Chapter.

3.5.2 Mandatory set of wholesale services

Table 3-4 gives a list of mandatory wholesale services that the OiV, as the operator of the backhaul infrastructure built within the Programme, must provide all the operators using the wholesale access to this infrastructure. Mandatory wholesale services differ depending on whether the NGN backhaul links are realised via fibre-optic cables or via directional wireless links.

Besides providing the service of leasing dark fibre on all fibre-optic backhaul links, the OiV must provide all operators also with the service of leasing free space in cable ducts in all the cases of new cable ducts built within the Programme and managed by the OiV. Additionally, the accommodation service (co-location) for operator's passive and active network equipment must be provided in the NP-BBI backhaul network nodes.

Where the directional wireless links are used, the OiV must provide operators with the wholesale service of leasing guaranteed transmission capacity. In the nodes of wireless backhaul links,[29] the OiV must provide also the accommodation service (co-location) for operator's passive and active network equipment. Besides these services, the OiV must provide also the service of leasing free space on antenna masts used for the directional wireless links managed by the OiV.

[29] At places where the wireless backhaul links represent a continuation of the basic fibre-optic routes of the NP-BBI backhaul network to targeted remote settlements, the nodes of backhaul links realised via directional wireless links will partially coincide with the nodes of fibre-optic backhaul links.

Table 3-4 – List of mandatory wholesale services on the NP-BBI backhaul infrastructure

Backhaul link type	Wholesale service	Note
Fibre-optic links	Leasing of dark fibres	-
	Leasing of free space in cable ducts	It applies only to the backhaul links implemented via newly built cable ducts managed by the OiV.
	Leasing of equipment co-location space	In the backhaul network nodes, for accommodating the passive and active network equipment of operators using the NB-BBI wholesale services.
Directional wireless links	Leasing of guaranteed transmission capacity	-
	Leasing of equipment co-location space	In the backhaul network nodes, for accommodating the passive and active network equipment of operators using the NB-BBI wholesale services.
	Leasing of free space on antenna masts	It applies only to the masts used for directional wireless links within the project unit PU-A and managed by the OiV.

The obligations of providing the wholesale services, as defined by this Programme, do not exclude the possibility that in some future period the OiV will be declared as an operator with significant market power (SMP) on any relevant market associated with the lease of electronic communications infrastructure, if that would be necessary according to the market analysis done by HAKOM and in accordance with the legislative framework of the ECA.

3.5.3 Determination of wholesale prices

Given the fact that HAKOM currently does not regulate the services of a dark fibre lease (i.e. the leasing of lines realised via dark fibres), it is not possible in this Programme to apply the principle of determining the wholesale prices for this service by method of *benchmarking* against the regulated prices on the national electronic communications market. Furthermore, due to the prevailing unavailability of data on the prices of the same services in EU countries, the benchmarking against the prices from EU countries is also impossible (available data on prices in EU countries is primarily related to the core networks with a presence of infrastructure competition or to the regulated prices in access networks, where both these types of a dark fibre lease are incomparable with the services of a dark fibre lease within the NP-BBI backhaul network).

Consequently, with the aim of promoting the development of NGA networks as a primary objective of the project unit PU-A of the Programme, the wholesale price for the service of leasing the dark fibres within the NP-BBI network will be determined on the principle providing to operators a cost-effective business model of physical access to the NGA networks in targeted settlements.

The price for the service of leasing the guaranteed transmission capacity on the backhaul links realised via directional wireless links can be determined by benchmarking against the prices within the regulated market of active layer leased lines. However, due to

the need of applying the uniform principle for determining the wholesale prices throughout the Programme, and with the aim of promoting the development of NGA networks in all targeted settlements, for the service of leasing the guaranteed transmission capacity of directional wireless backhaul links within the Programme will be applied the same principle of determining wholesale prices, providing to operators a cost-effective business model of physical access to the NGA networks in targeted settlements.

The above-mentioned principle of determining the prices as well as the initial price values for services of leasing dark fibres and leasing guaranteed transmission capacity via directional wireless backhaul links (hereinafter jointly referred to also as *key wholesale prices*) are explained in detail in Chapter 4.2.1.

The wholesale prices for all other mandatory services (see Table 3-4) will be determined by benchmarking against the regulated prices, or in the case of non-regulated services, applying the principle of *cost oriented wholesale prices.*

A procedure for the approval of wholesale prices and conditions for all the mandatory wholesale services within the Programme (see Figure 3.1) is described below.

The procedure for the approval of wholesale prices and conditions must be carried out initially, just before the NP-BBI backhaul infrastructure becomes operationally available to operators, and then subsequently every 12 months in order to align the prices with the market changes. In view of key wholesale prices, these changes are related to the market parameters that have a major impact on the business profitability of the operators that use the backhaul infrastructure in targeted areas (primarily due to the development of supply and demand on the retail market of NGA services at the national level in general and in the targeted areas of the Programme implementation in particular). For all other wholesale prices, the market changes are related to the changes of comparable regulated prices or changes of parameters affecting the cost orientation of wholesale prices.

Within the procedure for approving the NP-BBI wholesale prices and conditions the OiV proposes to the CAP the wholesale prices and associated technical and commercial conditions for all the mandatory wholesale services supported via NP-BBI infrastructure. The CAP will consider the proposed wholesale prices and conditions through consulting with all the operators on the market, including the existing users and potential new users of the NP-BBI backhaul infrastructure. This can be carried out also as a public consultation. Within this approval procedure the CAP will also seek the HAKOM's opinion about the proposed NP-BBI wholesale prices and conditions. In adopting this opinion, HAKOM will take into account the impact of the proposed NP-BBI wholesale prices and conditions on all the relevant markets of leased lines (including also the markets of leased electronic communications infrastructure), as well as the general impact on all the aspects of the development of the retail market of NGA services and related wholesale markets of physical and *bitstream* broadband access in the targeted areas of the Programme[30]. During the final approval of the

[30] It comprises the market of retail of broadband access, the market of wholesale (physical) access to network infrastructure as well as the market of wholesale broadband access.

wholesale prices and conditions, the OiV and the CAP will also jointly consider the relevant accounting data related to the OiV's business operation within the project unit PU-A, in order to enable the sustainable business operation of the OiV within the project unit PU-A on a non-profit basis (see also Chapter 3.6 describing the *clawback* procedure).

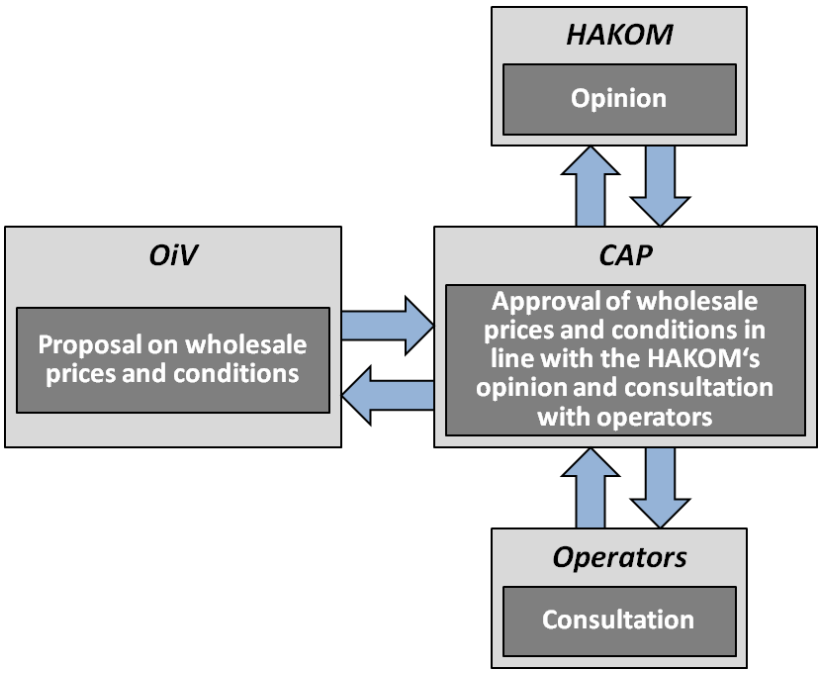

Figure 3.1 – Procedure for approving the wholesale prices and conditions in the Programme

In order to ensure the maximum transparency in providing the wholesale services via the NP-BBI network, the OiV will publish a Reference Offer laying down all the relevant technical and commercial conditions for providing the NP-BBI wholesale services, including also the wholesale prices. The updated version of the Reference Offer will be published with each change of the NB-BBI wholesale prices and conditions. The Reference Offer will be publicly available at the CAP's and OiV's websites. Detailed technical data on routes and nodes of the NP-BBI backhaul infrastructure, prepared in suitable electronic forms including also the access to data using the OiV's network interface, will be made available to all the operators using the NP-BBI backhaul infrastructure.

3.6 Refund of excessive aid (*clawback*)

Although, in accordance with the provisions of Article78) and footnotes 96 and 113 of the Broadband Guidelines, it is not necessary to apply the procedure for verifying the excessive aid (*clawback*) in the case of implementing the public DBO investment model and wholesale business model, this procedure nevertheless will be applied for this Programme. The reason for such approach is the intention of achieving the highest possible level of transparency in the Programme implementation, additionally comprising also the project unit PU-B that does not involve State aid.

Basic principle of the clawback is that the entire profit, if any, within the project unit PU-A should be (re)invested in expanding the NP-BBI backhaul infrastructure in accordance with the objectives and structural rules of the Programme. Given the obligation of accounting separation for the project unit PU-A in relation to the project unit PU-B and all other OiV's business activities, the OiV and the CAP will jointly determine the eventual profit related to the business activities within the project unit PU-A in the following moments of the Programme implementation:

- in the course of the year 2020, after the expected completion of the entire financial year in which the full capacities of the NP-BBI infrastructure built in the first phase of the Programme were offered on the market (completing the infrastructure construction within the first phase of Programme is scheduled for the end of 2018);
- in the course of the year 2024, after the expected completion of the entire financial year in which the full capacities of the NP-BBI infrastructure built in both phases of the Programme were available on the market (completing the infrastructure construction within the second phase of Programme is scheduled for the end of 2022).

For the avoidance of doubt, it should be noted that, for the purposes of implementing the procedure of verifying the excessive aid, the profit realised within the project unit PU-A will be expressed after deducting the amortisation costs of the NP-BBI network assets, the NP-BBI financing costs (interest), and the profit tax, according to the share of these costs related to the project unit PU-A.

The funds from the eventually determined profit within the project unit PU-A may be invested in expansion of existing NP-BBI routes and nodes or construction of new nodes and routes to all the justified settlements that were not included as targeted settlements in the first and second phase of the Programme (in accordance with the rules for determining settlement colours described in Chapter 3.1). The OiV and the CAP will jointly determine the locations of possible additional investments from the realised profit. In order to assess the justifiability of additional investments in the NP-BBI expansion, the OiV and the CAP must consult with the operators on the market.

3.7 Transparency of the Programme implementation and obligations of reporting to the European Commission

In order to ensure the transparency of the Programme implementation, according to the provisions of Article 78j) of the Broadband Guidelines, the CAP will establish a website dedicated to the Programme. This website will contain all the information related to the Programme implementation and will be regularly maintained. The CAP will regularly collect the necessary information from the OiV. Information on the CAP's website must include at least the following:

- information on the status of the Programme implementation (preparatory activities for each phase, planning, construction, operation), with links to key activities requiring full transparency (public consultation procedures, consultations with operators, public procurement procedures);
- financial information on the execution of the Programme (total funds invested in the Programme, funds paid from the ERDF, State aid amounts paid within the project unit PU-A);
- links to the approved wholesale conditions and prices, i.e. the OiV's Reference Offer for the access to the NP-BBI backhaul infrastructure;
- basic information on the operation of the NP-BBI (the number of wholesale users within the PU-A, the length of the built routes of infrastructure, the number of targeted settlements covered by the NP-BBI and the number of nodes).

The CAP's obligations related to reporting to the European Commission are also laid down within the Article 78k) of the Broadband Guidelines. The CAP will collect all the relevant information on the Programme implementation and at least every two years will report on the Programme implementation to the European Commission. Such reports will at least contain the following information:

- amounts of State aid granted;
- basic information on the operation of the NP-BBI (the number of wholesale users within the PU-A, the length of the built routes of infrastructure, the number of targeted settlements covered by the NP-BBI and the number of nodes).

4 Financial aspects of the Programme implementation

This Chapter gives the summary of the financial aspects of the Programme implementation, including the assessment of the necessary investment resources for the Programme implementation in two phases, the estimates of revenues and operating costs, the principles of cost distribution between both project parts (PU-A and PU-B), and the analysis of financial sustainability of the Programme.

Financial aspects of the Programme are discussed here primarily because it is necessary to implement the pre-notification and notification procedures in the *Directorate-General for Competition* (DG COMP) of the European Commission. This discussion is based on a preliminary NP-BBI business plan (hereinafter abbreviated as a *business plan*) prepared in parallel with this document. All the remaining financial aspects of the Programme, which must be analysed in the course of preparing the Programme as a major project co-financed by the ESI funds, will be elaborated in parallel within the scope of preparing the appropriate *cost benefit analysis* (hereinafter CBA) for the purpose of obtaining the approval of Programme co-financing from the ERDF.

The financial aspects of the Programme analysed in this Chapter follow the anticipated division of the Programme implementation in two phases, as it is described in Chapter 5.1.

4.1 Investment costs of the Programme

The business plan takes into account the following investment costs required for building the NP-BBI backhaul infrastructure and connecting the public users in targeted settlements:

- designing the NP-BBI infrastructure and obtaining all necessary permits and approvals during the preparation of the Programme;
- managing and controlling the Programme implementation;
- all equipment, materials and construction works for the cable duct systems using micro-ducts and/or micro-duct bundles (assumed cable duct characteristics and capacities are in accordance with the Ordinance [13][31]), excluding the routes where the laying of fibre-optic cables in the existing cable ducts is anticipated (estimated as at least 14% of the total length of the anticipated routes), as well as the routes to be carried out via directional wireless links (estimated at 3% of the total length of the anticipated routes);

[31] Two ducts along the local and county roads as well as four ducts along the inter-county and the main roads and highways are stipulated by the Ordinance [13]. This Ordinance stipulates also that these ducts should be in principle high-density polyethylene ducts with diameter of 50 mm or equivalent micro-duct bundles.

- procuring and laying the 12- or 24-fibre optical cables on the backhaul link routes to targeted settlements, in accordance with the capacities defined in Annex (see explanation in Chapter 5.3.3);
- procuring and laying 4-fibre optical cables per individual location of targeted public users not coinciding with the micro-location of the NP-BBI node in a settlement;
- arranging and equipping the NP-BBI nodes for accessing the dark fibre infrastructure and accommodating the passive and active network equipment of the operators that are wholesale users within the project unit PU-A as well as for the passive and active network equipment for connecting the public users within the project unit PU-B;
- all associated materials, equipment and works related to the connection and testing of optical fibres;
- constructing and arranging the antenna mast infrastructure as well as procuring the equipment required for the realisation of directional wireless links on a minor part of the routes covered by the second phase of the Programme[32].

The costs of eventual installation of active network equipment for connecting the public users within the project unit PU-B are not taken into account in the business plan at this time. For now, it is just assumed that these public users will utilise, within the scope of this Programme, only the services of leasing the backhaul link capacity on the passive dark fibre level or only at the level of leasing the guaranteed symmetrical transmission capacity, in the case of the backhaul links realised via directional wireless links.

Table 4-1 gives an overview of the estimated investment costs per Programme implementation phases. The estimate includes also the additional contingency costs related to works on infrastructure construction amounting up to 10% of the basic construction costs. This estimate does not include value-added tax (hereinafter VAT).

Table 4-1 – Estimated investment costs of the Programme

Implementation phase of the Programme	Investment costs [HRK]	Investment costs [EUR][1]
Phase 1	346,822,502.13	45,755,104.45
Phase 2	332,740,415.58	43,897,303.02
TOTAL	679,562,917.71	89,652,407.47

[1] *According to the Croatian National Bank (hereinafter HNB) average exchange rate for the EUR on 4 July 2014: 1 EUR = HRK 7.579974.*

[32] These are the routes to remote central settlements of the LSUs with less than 1,000 inhabitants in mountainous areas and on small islands covered by the second phase of the Programme. See also Chapter 5.4 and Annex for an indicative list of the targeted settlements to which the backhaul links via directional wireless links will be implemented.

The above-mentioned investment costs will be in a major part covered by the ERDF funds, i.e. within the OPCC under the investment priority 2a *Extending broadband deployment and the roll-out of high-speed networks and supporting the adoption of emerging technologies and networks for the digital economy*. The remaining smaller part of the Programme investment costs will be covered by the national co-financing funds.

The total aid amount in both phases of the Programme for the project unit PU-A which includes State aid is estimated at HRK 314.8 million (see explanation in Chapter 4.4.1 related to the principles of distribution of costs between the project unit PU-A and project unit PU-B). The exact aid amount will be known upon completing all the public procurement procedures within the Programme. Since the entire investment amount will be covered by public funds, including the funds from the ERDF and national co-financing funds, the aid intensity will amount to 100%.

4.2 Revenues in the Programme

Revenues in the Programme include the revenues from wholesale fees paid to the OiV by the operators using the backhaul infrastructure within the project unit PU-A as well as the revenues from the fees paid to the OiV by the public users within the project unit PU-B. In order to estimate these revenues, the principles of determining the prices in both project units are defined below.

4.2.1 Wholesale prices within the project unit PU-A

The basic principle of determining the wholesale prices for using the backhaul infrastructure capacities within the project unit PU-A is that for each operator must be enabled the commercially profitable offer of NGA services to its potential end-users in each targeted settlement covered by the Programme, including the realisation of physical access to the NGA infrastructure in targeted settlements, whether it is realised using the operators' own NGA infrastructure or the wholesale access to the NGA infrastructure of other operators. Physical access means the access to local loops in FTTH networks and sub-loops in FTTx networks as well as the *bitstream* access at the level of the relevant access network nodes. Only the application of such principles can ensure the prerequisites for developing the NGA infrastructure and increasing the use of NGA services as well as for increasing the competitiveness of operators and further liberalising the electronic communications market in all parts of Croatia.

Following the assumption that each operator using the backhaul infrastructure within the Programme will lease a pair of optical fibres on each individual route between two nodes of the NP-BBI network enabling the backhaul link to a particular targeted settlement, the wholesale price is determined as a unit price for leasing a dark fibre pair per kilometre of the length of the route containing the leased fibre pair. The wholesale price determined in such a way will be valid for the entire Croatian territory on which this Programme will be carried out and will be independent on the technology or transmission capacity that a particular operator will implement or achieve using the leased optical fibre pair.

The wholesale price for leasing guaranteed symmetric transmission capacity for the backhaul links realised via directional wireless links is determined analogously to the principle of determining the wholesale price for leasing a dark fibre pair. This wholesale price will be expressed per unit transmission capacity in Mbit/s and kilometre of the length of the route realised using the leased directional wireless link, and will be valid for the entire Croatian territory on which the Programme is carried out[33].

The basic assumptions for the relevant market parameters used for determining the initial values of key wholesale prices within the project unit PU-A are given below (see Table 4-2). These assumptions are aligned with the generic assumptions used in the analysis of NGN backhaul capacity needs in Chapter 1.7.1. The table gives the estimated values for the year 2022 as a year for which the completion of the NP-BBI construction and the achievement of its full capacity is planned. Since the estimation of future values of market parameters can never be completely reliable, the table also gives the corresponding value variations regarding the estimated baseline values of these parameters used in the associated sensitivity analysis of key wholesale prices with respect to a particular market parameter.

Table 4-2 – Estimated values of market parameters used for the calculation of key wholesale prices within the project unit PU-A

Market parameter	Value in 2022	Variation
Average household penetration of NGA services[1]	80%	± 20%
Monthly Average Revenue Per User (ARPU)[2]	HRK 168.00	± 20%
Average maximum bandwidth of the NGA connection per user[3]	98.1 Mbit/s	± 20%
Backhaul link contention rate[4]	15	± 20%

[1] Number of active NGA connections within the total number of households in the targeted settlements of the Programme implementation.
[2] Value excluding VAT, includes all additional services realised through the NGA broadband connection (e.g. IPTV and voice telephony).
[3] It refers to the actually achieved maximum downstream bandwidth per NGA connection regardless of the maximum bandwidth officially declared for a particular NGA retail package. This value is aligned with the share of targeted settlements with implemented FTTH and FTTx solutions in the access network (see Chapter 1.7.1).
[4] It is the ratio of the sum of declared maximum bandwidths of access connections for all users and installed capacity of the backhaul link covering these users. See also Chapter 1.7.1.

The above-mentioned values of market parameters were estimated in line with the following assumptions:

- the present retail prices of NGA services in Croatia, which were in 2014 higher than HRK 200.00 on a monthly level[34], will experience, with growing availability of NGA broadband and increased use of NGA services during the next period of two years, a significant drop and will be closer to the current average retail prices of basic

[33] As the wholesale price for leasing guaranteed symmetric transmission capacity via directional wireless links depends on the utilised transmission capacity, it can be adjusted to the actual average bandwidths for NGA retail services if they would be significantly different from those assumed in given calculation (see Table 4-2). The adjustment procedure will be carried out within the regularly revision of the wholesale prices (see Chapter 3.5.3).
[34] According to the prices of HT's [33] and VIPnet's (B.net's) [34] NGA retail packages - see also Chapter 1.6.2.

broadband access - at the same time it is a prerequisite for increasing the utilisation of NGA services and substituting the basic broadband access with the NGA, given the average disposable income of broadband end-users in Croatia;

- it is expected that in the future there will be a further decline in retail prices of broadband access in general, including the NGA services (by an average of 1% per year).

The assumed average number of operators realising the physical access in NGA networks in targeted settlements (where these operators are simultaneously also the users of the NP-BBI backhaul infrastructure) depends on the size of the settlement as follows (see also Table 4-5):

- for all targeted settlements having more than 10,000 inhabitants - 3 operators;
- for all targeted settlements having between 5,000 and 10,000 inhabitants - 3 operators;
- for all targeted settlements having between 2,000 and 5,000 inhabitants - 2 operators;
- for all targeted settlements having between 1,000 and 2,000 inhabitants - 1 operator.

These estimated average values of the number of operators using the backhaul infrastructure are only assumptions for the Programme business model analysis, while the actual anticipated capacities of the NP-BBI backhaul infrastructure in each targeted settlement with less than 2,000 inhabitants anticipate the dark fibre capacity for at least 2 operators, and in the settlements with more than 2,000 inhabitants for at least 5 operators (see Chapter 5.3.3).

Following all the above-mentioned assumptions, the business plan determines the basic values and the value ranges of key wholesale prices for the leasing of a dark fibre pair as well as for the leasing of guaranteed symmetric transmission capacity for the backhaul links realised via directional wireless links (sees Table 4-3). The value ranges are determined by variations in the assumed values of the market parameters given in Table 4-2, where the minimum and maximum values refer to the worst case and the best case of a combined variation of all market parameters.

In determining the ranges of key wholesale prices it was taken into account that the operators' total wholesale costs of leasing the backhaul link capacity amounts a maximum of 15% of the total expected revenue of the operator that provides end-user with the services on the retail market. The final values of the key and all other wholesale prices will be initially determined at the beginning of the NP-BBI network operation, and will be subsequently revised at least once a year, all in accordance with the procedure described in Chapter 3.5.3.

Table 4-3 – Ranges of key wholesale prices of the Programme within the project unit PU-A

Wholesale price	Minimum value in the range	Baseline value	Maximum value in the range
Leasing of a dark fibre pair (HRK / pair / km, monthly)	49.00	65.00	85.00
Leasing of guaranteed symmetric transmission capacity of a directional wireless link (HRK / Mbit/s / km, monthly)	0.07	0.15	0.30
NOTE: The prices excluding VAT are stated.			

An alternative way of expressing the wholesale prices within the project unit PU-A

Without changing the basic principle for calculating the key wholesale prices described at the beginning of this Chapter, also the possibility of applying an alternative way of expressing the wholesale prices for a dark fibre pair lease, whereby the price would not be expressed per kilometre of the length of the used routes, was considered in the course of preparing this document. This alternative way would imply expressing the wholesale price per number of NGA active end-users for each operator utilising the NP-BBI backhaul infrastructure in all targeted settlements. Applying this alternative way of expressing the wholesale prices, all the targeted settlements of the same population size would be equally attractive to operators, regardless of their distance from the transitional node or the nearest NP-BBI network node. In addition, expressing the wholesale prices by the number of active users within the targeted settlement allows a more even distribution of the operators' operating costs by following the increase of the number of NGA end-users in targeted settlements.

Table 4-4 shows the range of values for the wholesale prices for a dark fibre pair lease in accordance with this alternative way of expressing the wholesale price per number of active NGA end-users served by a particular backhaul link utilising a particular fibre pair.

Although it is not clear whether this alternative way of expressing the wholesale prices might be compliant with the rules and the present practice of State aid for broadband networks at the EU level, this possibility is described here for informational purposes and in line with expectations that the operators participating in the public consultation will give their specific comments regarding this possibility. The possibility of applying this alternative way of expressing the wholesale prices will be directly verified during the Programme pre-notification procedure in the European Commission bodies.

Table 4-4 – Range of the wholesale price for leasing a dark fibre pair in case of an alternative way of expressing the wholesale price

Wholesale price	Minimum value in the range	Baseline value	Maximum value in the range
Leasing of a dark fibre pair (HRK / pair / active NGA end-user, monthly)	8.80	11.00	14.50
NOTE: The prices excluding VAT are stated.			

4.2.2 Prices within the project unit PU-B

Although the project unit PU-B does not include State aid, the basic principle of determining the prices that the public users within the project unit PU-B will be paying to the OiV for the services of connecting them to the NP-BBI network is given here for the purpose of transparency of the entire Programme description. The types of services that the OiV will be providing to the individual public users within the project unit PU-B are still undefined. Whether these will be only the services of connecting these public users to the public NGA infrastructure on a passive network layer or these services will include also connecting these public users to the NGA infrastructure on an active network layer, this will be precisely determined in the course of preparing the Programme implementation, i.e. while preparing the necessary analyses regarding the application for co-financing the Programme by the ERDF.

The basic principle for determining the prices within the project unit PU-B includes the rule that the revenues from these fees must allow the coverage of all OiV's operating costs of managing and maintaining the parts of the NP-BBI network and equipment utilised for the needs of public users within the project unit PU-B (details regarding the distribution of the NP-BBI network costs between the project units PU-A and PU-B are given in Chapter 4.4.1).

Following this principle, the business plan of the Programme anticipates that the price for the service of leasing a dark fibre pair within the project unit PU-B will be in the range of HRK 40.00-50.00 per kilometre of the route length monthly. These values are not necessarily the individual fees for each public user in the PC-B, as multiple public users will be able to share the capacity of the single link. The corresponding details will be determined in the course of preparing the Programme implementation.

4.3 Operating costs of the Programme

The Programme business plan anticipates the following operating cost of the NP-BBI network:

- the costs of maintaining the infrastructure on all fibre-optic routes of the NP-BBI network and the infrastructure and equipment of directional wireless links on the routes that are realised in this way;
- the costs of maintaining the backhaul network nodes and all associated equipment in these nodes;
- the costs related to establishing and providing of services to all NP-BBI users and charging the wholesale services to operators within the project unit PU-A as well as collecting the service fees from public users within the project unit PU-B;

- the costs related to the fees for utilising the existing cable ducts, as well as to the fees for the right of way over private land for the newly built cable duct routes (i.e. where the NB-BBI routes are not within the corridors of public roads)[35];
- the costs of regulatory fees for the use of radio frequency spectrum for directional wireless links;
- all common costs of business activities within the Programme (management, administration).

In order to simplify the analysis of the framework business plan, all the costs of maintaining the built infrastructure and installed equipment are estimated annually at 1.5% of the initial capital costs of infrastructure and equipment. Likewise, the common costs are estimated annually at 1.5% of the initial capital costs of infrastructure and equipment. The distribution of these costs between the project units PU-A and PU-B is explained in Chapter 4.4.1.

4.4 Sustainability of the business plan

The results of the sustainability analysis of the framework business plan in accordance with the assumptions described in Chapters 4.1-4.3 are presented below. The presented results will be used in the course of conducting the pre-notification and notification procedures for obtaining the approval of compliance with the State aid rules for the project unit PU-A. Consequently, in order to facilitate determining the portion of the costs related to the project unit PU-A, firstly the principles of distributing the Programme costs between the project units PU-A and PU-B are presented.

4.4.1 Distribution of costs between project units

The distribution of costs between the project unit PU-A and the project unit PU-B was determined using the method of *Fully Distributed Costs* (hereinafter FDC; also *Fully Allocated Cost* - FAC). Since direct costs of providing the services in both project units are mostly based on capital and operating costs of infrastructure and equipment in the backhaul links, these direct costs are distributed between the project unit PU-A and the project unit PU-B in accordance with the proportion of the NP-BBI network capacity used for each of the project units on the routes to each individual settlement. The exception are only the costs of infrastructure related to the realised connections of individual public users to the access networks, which can be directly allocated to the project unit PU-B (the total share of capital costs related to this infrastructure in the entire Programme is estimated at 4.2%, given the significantly shorter lengths of such routes in relation to the lengths of backhaul routes). The distribution of costs based on a proportion of utilised capacities of project units is also

[35] The OiV, as a public company, does not pay right of way fees for utilising the corridors of public roads for constructing the electronic communication infrastructure (according to Article 68, paragraph 2 of the Act on roads). It is assumed that this rule will be valid also during the future implementation of this Programme. The backhaul infrastructure will be built mostly within the corridors of public roads.

applied to the common business operating costs within the Programme, which are not unambiguously assignable to a particular project unit (management, administration).

To determine the proportion of capacity on routes to each targeted settlement, the business plan assumes the average number of leased fibre pairs for the needs of operators and public users as specified in Table 4-5. The cost-effectiveness, i.e. the business profitability of the individual operator using the NP-BBI backhaul infrastructure for the physical access in the settlement within the project unit PU-A, is assumed based on the estimated value range of the wholesale prices from Chapter 4.2.1. Consequently, the expected number of operators is reduced for the settlements with a smaller population and a smaller number of potential end-users of NGA services. The capacity estimated for the needs of the project unit PU-B is modulated according to the average number of individual public users in all targeted settlements (see Annex) and the assumption of shared use of a single dark fibre pair by multiple public users sharing the transmission capacity on the active network layer.

Table 4-5 – Average used capacities in the project units by the size of targeted settlements

Size of targeted settlement	Number of used dark fibre pairs	
	PU-A[1]	PU-B[1]
More than 10,000 inhabitants	3	4
Between 5,000 and 10,000 inhabitants	3	3
Between 2,000 and 5,000 inhabitants	2	3
Between 1,000 and 2,000 inhabitants	1	2
Less than 1,000 inhabitants	0	1
[1] *It refers to all routes to the targeted settlement.*		

In line with the above-mentioned assumptions, the business plan estimated that on completing the second phase of the Programme and linking all the targeted settlements until the end of 2022, the share of used NP-BBI capacities for the project unit PU-A will amount to 43.8%, while the remaining 56.2% will be used for the needs of public users within the project unit PU-B. Therefore, these shares are applied for distributing the investment and operating costs between the project units within the business model[36].

4.4.2 Sustainability analysis of the business plan for the project unit PU-A

Sustainability of the business plan is analysed by applying the *net present value* method (hereinafter NPV) within a period of 15 years and assuming a discount rate of 10% (see Table 4-6). Given the estimated share of used NP-BBI network capacities for the project unit PU-A of 43.8%, the total investment and operational costs of the NP-BBI network allocated to the project unit PU-A are allocated in accordance with this share. The

[36] For the avoidance of doubt, these distribution shares refer only to the investment and operating costs in the business model, while the revenues for each of project units are assumed in accordance with the principles described in Chapters 4.2.1 and 4.2.2.

anticipated price for leasing a dark fibre pair is HRK 65.00 per km monthly in accordance with the wholesale price baseline value used in the calculation of operators' business profitability in Chapter 4.2.1. It is assumed that the full expected NP-BBI network capacity will be utilised in the period of an average of six months from starting the operation of the network part to each targeted settlement. The residual value of the NP-BBI network assets within the project unit PU-A is included in the PU-A incomes in the final year of the analysis of the business model.

The NPV at the end of the considered period of the business model (2030) amounts HRK -228.9 million and the internal rate of return (hereinafter IRR) amounts -4.8%. This leads to the conclusion that it is impossible to achieve a sustainable business plan applying the estimated value of the wholesale price for leasing a dark fibre pair while this value guarantee a sustainable business model of physical access to the NGA infrastructure for the operators in targeted settlements. This also justifies the application of State aid within the project unit PU-A in order to achieve the sustainable business model of the NP-BBI network management within this project unit. For the purpose of illustration, to achieve the internal rate of return (IRR) that would be at the level of the assumed discount rate of 10%, without changing any other assumption of the business model, the price for leasing a dark fibre pair should be as high as HRK 281.00 per km monthly, which is four times more in comparison to the optimal price value of HRK 65.00 per km monthly estimated in accordance with the analysis described in Chapter 4.2.1.

Table 4-6 – Sustainability parameters of the business plan for the project unit PU-A

Parameter of the business plan analysis	**Parameter value**
Discount rate	10%
Time period considered	2015-2030
Time period for the construction of the first phase	2016-2018
Time period for the construction of the second phase	2019-2022
Average share of the utilised NP-BBI network capacities for the project unit PU-A upon completing the second phase (2022)	43.8 %
Investment costs of the first phase	HRK 172,165,693.50
Average annual operating cost of the first phase	HRK 4,304,142.34
Total investment costs of both phases	HRK 314,824,503.85
Total average annual operating cost of both phases	HRK 7,870,612.57
Assumed price for leasing a dark fibre pair (monthly per km of the route length)	HRK 65.00
Net Present Value (NPV) at the end of the period considered (2030)	**HRK -228,859,124.61**
Internal Rate of Return (IRR)	**-4,8%**

4.4.3 Sustainability analysis of the overall business plan of the Programme

The sustainability analysis of the overall business plan of the Programme, comprising both project units, is provided here only at a framework and informational level, given that the sustainability of the entire Programme will be analysed in detail and accurately determined within the preparatory activities for co-financing by the ERDF. In the course of preparing this document, it was not possible to predict in detail all the procedural modalities of preparatory activities for co-financing the Programme by the ERDF, because it will be determined by the content of the national implementing rules for the financial period of the ESI funds 2014-2020. Therefore, only a basic description of the preparatory procedures for co-financing the Programme by the ERDF is given below.

Since this Programme is considered an *operation generating net revenue* after its completion (Article 61 paragraph 1 of the CPR [4]), it will be necessary to reduce the eligible Programme expenditures co-financed by the ERDF, that is, to calculate the modified ERDF *co-financing rate*, using one of the methods specified in Article 61 paragraph 3 of the CPR. This should not apply to the project unit PC-A, as a unit involving State aid, in accordance with Article 61 paragraph 8c) of the CPR[37]. In addition, for the entire Programme as a *major project*, all the provisions of Article 101 and Article 102 of the CPR related to the procedure for approval of a major project are applicable.

Regardless of the options of calculating the ERDF co-financing rate, the framework business plan estimated the total ERDF co-financing rate of the Programme, retaining all the cost and revenue assumptions given in Chapters 4.1-4.3. The method of *discounted net revenue* of the operation is applied for both project units. The estimated ERDF co-financing rates are shown in Table 4-7.

Table 4-7 – Estimated ERDF co-financing rates for the Programme

Co-financed part	Co-financing rate
Project unit PU-A	82.0 %
Project unit PU-B	74.1 %
Entire Programme TOTAL	**77.6 %**

Based on the above-mentioned co-financing rates, it can be estimated that HRK 527.4 million within the total investment cost (HRK 679.6 million) will be possible to provide within the ERDF, while the remaining HRK 152.2 million will be necessary to provide within the national co-financing.

[37] This depends on the national implementing rules for the financial period of the ESI funds 2014-2020, which have not yet been adopted.

5 Programme implementation plan

This chapter describes the operational aspects of preparing and implementing the Programme, which includes:

- prioritising the targeted areas of the Programme and implementing the Programme in phases;
- the framework time-schedule for preparing and implementing the Programme;
- the planned locations of transitional nodes and backhaul infrastructure capacities;
- the indicative routes of backhaul infrastructure to be carried out via directional wireless links;
- the procedure for conducting the public consultation on the Programme.

5.1 Prioritising of targeted areas and phases of the Programme implementation

With regard to the planned funds for the Programme implementation within the ERDF and taking into account the justification of the Programme intervention in targeted settlements in accordance with the rules for determining the settlement colours as it is stipulated by the Broadband Guidelines and explained in detail in Chapter 3.1.1, all settlements with more than 1,000 inhabitants in which there are public users, as well as all smaller *central* settlements in the LSUs in which there are public users, are determined as targeted settlements having priority in building the NGN backhaul infrastructure and connecting the public users. Such approach to prioritising creates the preconditions for achieving a maximum of socio-economic impacts of the Programme implementation because the limited investment resources will be allocated to the largest settlements in all parts of Croatia, ensuring the availability of NGN backhaul infrastructure to the largest possible number of end-users, including also the public users within the project unit PU-B.

In addition, the Programme implementation is divided into two phases according to the specific phase coverage criteria (see Table 5-1). The first phase covers all targeted settlements with a minimum of 2,000 inhabitants. The second phase includes the remaining targeted settlements with a minimum of 1,000 inhabitants where there is at least one public user, as well as all remaining targeted central settlements in the LSUs. The implementation of both phases will be conducted on the entire Croatian territory and will include the targeted settlements in all counties.

Targeted settlements in the LSUs do not necessarily correspond to the central settlements of the LSUs in administrative terms, as it is defined by the town or municipality statutes. The central settlements in the LSUs with less than 1,000 inhabitants covered by the second phase of the Programme are determined in accordance with the locations and the

number of public users within each such LSU (public users, or the majority of public users, often are not concentrated in the central administrative settlement of such LSUs).

In the course of preparing the Programme implementation and designing the backhaul infrastructure routes, certain exemptions with respect to the defined phase coverage criteria and targeted settlements can be applied in both phases, namely:

- in the first phase, if the individual targeted settlements belonging to the second phase in accordance with the phase coverage criteria will be located on the designed routes of the first phase, such settlements will be included in the first phase;
- in the first phase, if the support for constructing the access networks within the framework of the Framework Programme in certain targeted settlements of the Programme will be anticipated within the time period of the first phase of the Programme, while the construction of NGN backhaul infrastructure reaching these settlements has not been initially planned for the first phase, such settlements will be covered by the first phase;
- in both phases, for all the settlements that are not covered by the phase coverage criteria (settlements with less than 1,000 inhabitants that are not *central* settlements of the LSUs, but where there are also public users), if these settlements are located on the designed routes of the NGN backhaul infrastructure, they will be included as targeted settlements for the purposes of connecting the public users within the project unit PU-B.

In accordance with the framework time-schedule of the Programme (see Chapter 5.2), it is anticipated that the implementation of the first phase of the Programme will be completed by the end of 2018, and the implementation of the second phase by the end of 2022.

Table 5-1 – Criteria of the Programme implementation by phases

Phase	Phase coverage criteria	Number of covered settlements	Share in the total population of Croatia
1	- all targeted settlements with at least 2,000 inhabitants	187	23.3%
2	- all remaining targeted settlements not covered by the first phase, with at least 1,000 inhabitants and in which there is at least one public user - all remaining targeted central settlements of the LSUs not covered by the first phase and in which there is at least one public user	449	10.9%
TOTAL		636	34.2%

The division of the Programme implementation into two phases is motivated by the need of optimizing the overall operational implementation of the Programme over a longer period of time that will last until 2022, as well as of focusing the investment in the first phase on the larger settlements with a higher potential of end-users, i.e. the settlements where there is interest of a larger number of operators for utilising the NGN backhaul infrastructure capacities. In this way, the preconditions for a larger step forward in the use of NGA services in a shorter period by the end of 2018 are created.

The affiliation of targeted settlements to a particular phase of the Programme is specified in details in Appendix.

5.2 Framework time-schedule of the Programme

The framework time-schedule for preparing and implementing the Programme in the period 2014-2023 is shown in Figure 5.1.

The framework time-schedule will be subject to subsequent changes, depending on the actual time spent for implementing the key preparatory steps of the Programme. These key steps are primarily the procedures of Programme pre-notification and notification to the European Commission and the approval of the NP-BBI as a major project, also by the European Commission, as well as obtaining, in the course of the network design phase, all the necessary permits and approvals related to the NP-BBI network construction and implementing all the necessary public procurement procedures related to the Programme. The CAP and the CAOI (i.e. OiV) will take all the necessary measures to ensure that these key preparatory steps would be realised within these planned deadlines.

The implementation dynamics of the entire Programme is adapted to the anticipated dynamics of availability of the ERDF co-financing funds for the financial period of ESI funds 2014-2020. Consequently, also the NP-BBI network construction deadline is planned for the end of 2022, in order to predict enough time to carry out all the administrative procedures related to the payment of funds from the ERDF during the 2023.

The following time course for preparing and implementing the main Programme components is anticipated:

- finalizing the initial version of the Programme during July 2014;
- completing the public consultation on the Programme, as well as preparing the second version of the Programme, until January 2015;
- initiating the pre-notification procedure in the Directorate-General for Competition (DG COMP) of the European Commission during February 2015;
- initiating the notification procedure, also in the Directorate-General for Competition of the European Commission, depending on the duration of the pre-notification procedure but immediately upon its completion, expected in the first half of 2015;

- launching the preparation process of the Programme as a major project (in accordance with the CPR provisions) during the last quarter of 2014 and obtaining the Programme approval by the European Commission during 2015;
- launching the NP-BBI network design and obtaining all the necessary permits and approvals for the first phase of the Programme during 2015, depending on the progress and dynamics of initiated notification procedures and the preparation and approval of the Programme as a major project;
- it is expected that at the beginning of 2016, depending on the duration of the NP-BBI network design, it will be possible to start constructing a part of the first phase of the NP-BBI network, and that the first parts of the network will become operative by the end of this year (it is planned to finish constructing the first phase of the NB-BBI network by the end of 2018);
- conducting the second public consultation before the start of the second phase of the Programme is planned for 2017, in order to verify the initially specified targeted areas of the Programme implementation in view of the market changes since the first public consultation conducted in 2014;
- launching the network design and obtaining all the necessary permits and approvals for the second phase of the Programme is planned for 2018;
- constructing the second phase of the NP-BBI network is planned for the period from the beginning of 2019 until the end of 2022.

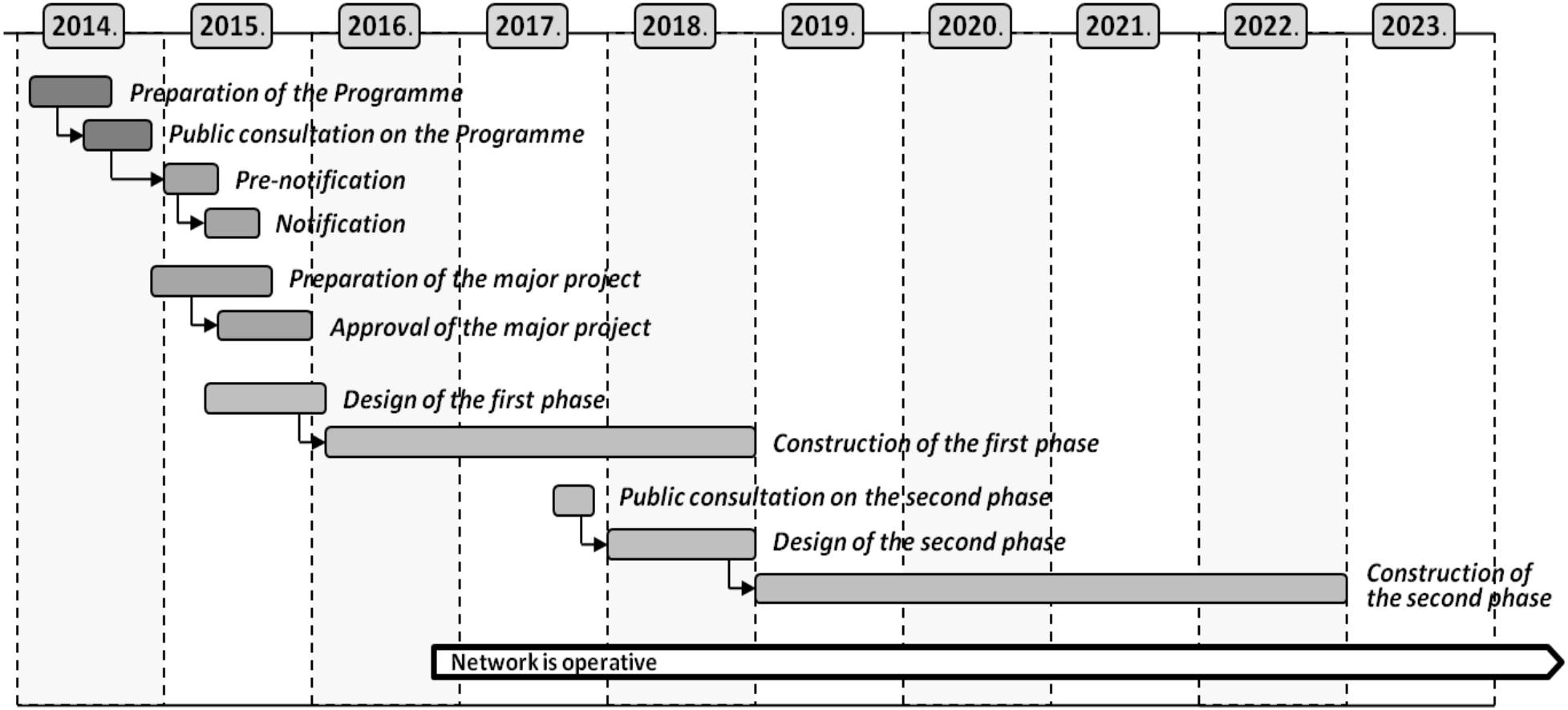

Figure 5.1 – Framework time-schedule for the preparation and implementation of the Programme

5.3 Planned locations of nodes and infrastructure capacities of the NP-BBI

5.3.1 Transitional nodes

Transitional nodes indicate the locations of transitions between the core and backhaul network (see also Chapter 1.6.3, Figure 1.6). The backhaul links are branching from the transitional nodes of the NP-BBI network to all the targeted settlements covered by the particular transitional node. Table 5-2 gives an overview of all the settlements where the NP-BBI transitional nodes are located. The locations of transitional nodes, marked as "N0", are also given within the list of settlements in Annex. The locations of transitional nodes are selected so that operators can ensure the appropriate core network links to these settlements under acceptable market conditions, including the competitive supply of transmission capacities by multiple operators, where this was directly verified during the public consultation on the Programme. This is aimed at creating the prerequisites for spatial optimization of the backhaul Infrastructure topology, i.e. at minimising the total investment costs of the backhaul infrastructure construction and the subsequent operators' costs related to the part of wholesale prices expressed per kilometre of the route length.

All transitional nodes will be built within the first phase of the Programme. Micro-locations of nodes within corresponding settlements will be determined in the course of designing the first phase of the Programme.

Table 5-2 – Locations of transitional nodes (N0)

Location of the transitional node
Slavonski Brod
Zagreb
Pula
Karlovac
Koprivnica
Osijek
Rijeka
Sisak
Split
Šibenik
Varaždin
Zadar

The NP-BBI backhaul infrastructure topology in view of the above-mentioned transitional nodes will be determined directly in the course of designing the first Programme phase. Given the geographical locations of targeted settlements in both Programme phases, this topology design will be aimed at minimizing the number of individual routes and the total length of all NP-BBI routes, in order to reduce the total investment costs of building the backhaul infrastructure. In all cases in which it will be feasible without a significant increase

of the total NP-BBI investment costs, the NP-BBI backhaul topology design will be aimed at implementing the backhaul infrastructure routes allowing simultaneous linking of at least a portion of the (major) targeted settlements with two transitional nodes via two spatially separated routes (ensuring the possibility of implementing redundant connections using the alternative physical routes, e.g. implementing the ring topology).

5.3.2 Other backhaul infrastructure nodes

One node of the NP-BBI backhaul infrastructure will be located in each targeted settlement of the Programme. These nodes will be equipped with the adequate infrastructure for accommodating the passive and active network equipment of operators within the project unit PU-A as well as for the needs of the public users within the project unit PU-B, according to the description given in Chapter 2.1.

In accordance with the rule of conditional wholesale access defined in Chapter 3.5.1, the nodes in grey and black settlements regarding the basic broadband (S_{osn} and C_{osn}) are marked in Annex as "N1". The nodes in white settlements regarding the basic access (B_{osn}), which operators may use also for the backhaul linking of basic broadband access services, are marked in Annex as "N2" (the total number of N2 nodes is only 6, given the relatively good availability of basic broadband access in Croatia).

5.3.3 Planned backhaul infrastructure capacities

The planned backhaul infrastructure capacities per routes reaching the targeted settlements are given in Table 5-3 and detailed for each targeted settlement in Annex. The planned capacities are determined in accordance with the expected capacity demands within both project units (see Chapter 4.4.1, Table 4-5) and in line with the capacities of fibre-optic cables available on the market (12 and 24 fibres). In addition, the planned capacities allow a capacity increase over the expected demand (a higher number of users within the PU-A and PU-B) and provide 4 fibres as a technological reserve.

For clarity, it is necessary to emphasize that the specified backhaul infrastructure capacities are also the largest backhaul infrastructure capacities on all individual routes from transitional nodes to targeted settlements. In other words, depending on the topological solution of the NP-BBI, the individual routes covering only the settlements with less than 2,000 inhabitants will be equipped with 12 fibres, while all remaining routes will be equipped with 24 fibres.

Table 5-3 – Planned backhaul infrastructure capacities per targeted settlements

Targeted settlements	Number of fibres on backhaul infrastructure routes to the targeted settlement	Number of fibres for the needs of the operators within the project unit PU-A
Settlements with more than 2,000 inhabitants	24 fibres	10 fibres
Settlements with less than 2,000 inhabitants	12 fibres[1]	4 fibres

[1] *If the settlements with less than 2,000 inhabitants are located along the routes linking the settlements with more than 2,000 inhabitants, all such routes will be built using 24 optical fibres.*

The capacities of the routes that will be carried out via directional wireless links will be determined subsequently during the NP-BBI infrastructure design. Since it is expected that the majority of, or all, backhaul links carried out via directional wireless links will be implemented for the targeted settlements with less than 1,000 inhabitants within the second phase of the Programme, it is likely that the necessary capacities of such links will be primarily adapted to the needs of the public users within the project unit PU-B.

5.4 Routes realised via directional wireless links

An indicative list of targeted settlements to which the backhaul links will be carried out via directional wireless links is given within Annex. The basic indication criteria were: the small number of inhabitants in the targeted settlement (less than 1,000), the relatively large length of the individual route to the targeted settlement (measured from the transitional node or from the nearest neighbouring NP-BBI network node reached by fibre-optic infrastructure) as well as the location of the targeted settlement in mountainous areas or at remote small islands. Consequently, all indicated targeted settlements, to which the directional wireless links will be built, are covered by the second phase of the Programme. Within these settlements, due to their small user potential, it is not expected significant interest of operators for the access within the project unit PU-A.

Final routes intended to be carried out via directional wireless links will be defined during the backhaul infrastructure design.

5.5 Public consultation on the Programme

During the public consultation that followed the completion of the first version of the document, the objections and comments on the entire Programme were received from the operators and all other participants on the electronic communications market. During this public consultation, the initial categorisation of targeted settlements by colours was verified in accordance with the collected relevant information on the state of the NGA networks and backhaul transmission networks, including the existing infrastructure and services as well as the operators' investment plans for the next three years.

The following basic questions and requests for proposals and comments were submitted to operators during the public consultation:

- in view of the verification of settlement colours (a state of existing network infrastructure and supply of services as well as operators' investment plans):
  a) whether, within the settlements that are initially marked in Annex as B_b and $S1_b$[38], they provide the retail NGA services (with minimum download speeds greater than 30 Mbit/s) on the entire inhabited area of the settlement via its own NGA infrastructure or via physical access to the NGA infrastructure of another operator (where there are satisfactory conditions for the physical access to this infrastructure), and what type of infrastructure they use for this purpose; as well as whether they consider that there are satisfactory conditions of availability and supply of leased lines with guaranteed capacity enabling the commercially profitable backhaul linking of these settlements with core nodes;
  b) if they do not provide the retail NGA services within the settlements initially marked in Annex as B_b and $S1_b$, do they consider that the current conditions of the supply of leased lines with guaranteed capacity within the backhaul network in these settlements (including the HT's services and the services of other operators), can assure the prerequisites for the infrastructure competition between NGA network operators, i.e. enable the commercially profitable access to these settlements for all interested operators;
  c) whether, within the settlements initially marked in Annex as B_b and $S1_b$, they have the sufficient backhaul capacities to offer the leasing of dark fibres linking the locations of transitional nodes (see Table 5-2) and these settlements in accordance with the capacities specified in this document (see Table 5-3), as well as whether they offer or are able to offer, without additional investments, the leasing of dark fibres at the level of wholesale prices specified in this document (see Table 4-3);
  d) whether, for the settlements initially marked in Annex as B_b and $S1_b$, they have at disposal the sufficient backhaul capacities to offer the services of leased lines with guaranteed symmetric capacities using Ethernet technologies for linking the locations of transitional nodes (see Table 5-2) and these settlements, as well as whether they are able to offer such services at the level of wholesale prices specified in this document (see Table 4-3);
  e) whether, in the settlements initially marked in Annex as B_b and $S1_b$, they are planning in the next three year period (during 2015, 2016 and 2017) the

[38] In the first version of the Programme, the designation $S1_b$ was used for settlements categorised as *problematic grey* regarding the justification of intervention by this Programme. The results of public consultation on the Programme and the corresponding information (on the state of the backhaul network) submitted by the operators on the market showed that sub-categorisation of grey settlements in *problematic* and *unproblematic grey areas* is unnecessary. See also Chapter 3.1.

investments in NGA networks, and if the answer is positive, which settlements, what NGA technologies and what planned investment amounts are considered (it refers exclusively to the plans for covering the entire inhabited area of the settlement);

f) whether, to cover the settlements initially marked in Annex as B_b and $S1_b$, they are planning in the next three year period (during 2015, 2016 and 2017) the investments in the NGN fibre-optic backhaul infrastructure that would correspond to the planned NP-BBI network in view of capacities (see Table 5-3) as well as supply conditions and wholesale prices of services (see Table 4-3), and if the answer is positive, which settlements, what NGN backhaul solutions and what planned investment amounts are considered.

- in view of the operators' interest for using the NP-BBI infrastructure and technical characteristics of the NP-BBI infrastructure:

g) whether they consider that the capacities of 4 and 10 optical fibres on the backhaul link routes to targeted settlements of the Programme, planned for the needs of operators within the project unit PU-A (see Table 5-3), are sufficient for the long-term development of the supply of NGA services based on the infrastructure competition between access network operators (including the physical access to the infrastructure of another access network operator);

h) whether they consider that the proposed number, locations and the spatial coverage of transitional nodes (see Table 5-2; the nodes marked as N0 in Annex) are adequate for the backhaul linking of all targeted settlements; in particular, whether they consider that in the proposed settlements that would contain transitional nodes exist the sufficient market supply of leased line services that would ensure the interconnection of all locations of transitional nodes (within the core network);

i) whether they think that the proposed principles of determining the key wholesale prices and their initial ranges (for leasing dark fibre pairs and transmission capacities of directional wireless links as described in Chapter 4.2.1) are adequate for the development of infrastructure competition between access network operators in targeted settlements of the Programme, either by building their own NGA network or by applying the physical access to the NGA networks of other operators; as well as, apart from that, to give their views and comments on the alternative way of expressing the wholesale prices for leasing dark fibre pairs according to the number of active retail users of the NGA in targeted settlements (as described in Chapter 4.2.1, Table 4-4);

j) whether they are interested in using the NP-BBI backhaul infrastructure for providing the NGA services to end-users within the settlements initially

marked in Annex as B_b and S_{1b}, and particularly for which of these settlements they are interested (assuming that in these settlements there is or will be built the NGA network having the possibility of physical access, e.g. via unbundled optical fibres or copper sub-loops and loops).

The operators' information provided in relation to the questions a), c), d), e), f) and j) is considered as confidential information, which will be used by the MMATI solely for verifying the settlement colours and assessing the operators' interests for utilising the NP-BBI infrastructure. Individual information provided by the operators participated in the public consultation will not be made available to third parties, including the implementation of the Programme pre-notification and notification procedures in the European Commission.

Abbreviations

ADSL	Asymmetric Digital Subscriber Line
ARPU	Average Revenue Per User
Broadband Guidelines	Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks
CAGR	Compound Annual Growth Rate
CAOI	Competent Authority for the Operational Implementation of the Programme
CAP	Competent Authority for Programme; State aid granting authority
CBA	Cost Benefit Analysis
CPR	Common Provisions Regulation
DAE	Digital agenda for Europe
DBO	Design, Build and Operate
DG COMP	Directorate-General for Competition
DH	Distribution hub - distribution node within the FTTH network
DOCSIS	Data Over Cable Service Interface Specification; a standard for data transmission over cable access networks
DSL	Digital Subscriber Loop; a standard for data transmission over copper twisted pair access networks
DVB-T	Digital Video Broadcasting - Terrestrial
ECA	Electronic Communications Act
ECI	Electronic Communications Infrastructure and other associated facilities
EPPC	Electronic Public Procurement Classifieds of the Republic of Croatia
ERDF	European Regional Development Fund
ESI	European Structural and Investment funds
FDC/FAC	Fully Distributed Cost Fully Allocated Cost
FINA	Financial Agency
Framework Programme	*National framework programme for the development of broadband infrastructure in areas lacking sufficient commercial interest for investments*; a State aid programme for access networks
FTTB	Fibre To The Building
FTTC	Fibre To The Curb/Cabinet
FTTH	Fibre To The Home
FTTP	Fibre To The Premises
GBER	General Block Exemption Regulation
GISF	Geo-information System for Fisheries
HAKOM	Croatian Regulatory Authority for Network Industries, see also NRA
HFC	Hybrid Fibre-Coaxial; access network architecture using a combination of fibre-optic and coaxial cables
HNB	Croatian National Bank
HT	Croatian Telecom Inc.; a former monopolistic operator (incumbent)
IRR	Internal Rate of Return
ISHEI	Information System of Higher Education Institutions
ISHEI	Information System of Higher Education Institutions
ITU	International Telecommunication Union
LSU	Local Self-Government Unit; town/city or municipality
LTE	Long Term Evolution; a standard for 4th generation (4G) mobile networks
MISA	Market Information System in Agriculture
MMATI	Ministry of Maritime Affairs, Transport and Infrastructure
MPoP	Metro Point of Presence
NGA	Next Generation Access (networks)
NGN	Next Generation Networks

NP-BBI	National Programme for Broadband Backhaul Infrastructure
NPV	Net Present Value
NSDI	National Spatial Data Infrastructure
OBC	Overview of Broadband Coverage, a HAKOM's web-application in the form of an interactive map *Areas with the Availability of Broadband Access*
OG	Official Gazette
OiV	Transmitters and Communications Ltd.
OJ	Official Journal of the European Union
OPCC	Operational Programme "Competitiveness and Cohesion"
PDH	Plesiochronous Digital Hierarchy
POTS	Plain Old Telephone Service; a traditional telephony service in fixed access networks
PPA	Public Procurement Act
Programme	*National Programme for the Development of Broadband Backhaul Infrastructure in Areas Lacking Sufficient Commercial Interest for Investments, as a Prerequisite for the Development of Next Generation Access Networks (NGA)*; a State aid programme for backhaul network
PU	Project Unit, a specific part of the Programme scope
QoS	Quality of Service
SAA	State Aid Act
SDH	Synchronous Digital Hierarchy
SME	Small and Medium Enterprise
SMP	Significant Market Power
TFEU	Treaty on the Functioning of the European Union
UFOI	Project of unification of fibre-optic infrastructure in companies that are in majority ownership of the Republic of Croatia
UMTS	Universal Mobile Telecommunications System; a standard for 3rd generation (3G) mobile networks
VAT	Value-Added Tax
VDSL	Very high bit rate DSL
WDM	Wavelength Division Multiplexing

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