THE EUROPE'S DIGITAL DECADE AND ITS IMPACT ON THE NGA MARKET POTENTIAL INDICATORS IN THE WESTERN BALKANS

Slobodan Mitrović*,
[0000-0002-8571-0970]
Valentina Radojičić,
[0000-0001-9811-5663]
Goran Marković,
[0000-0003-1271-9277]
Srđan Rusov
[0000-0002-5616-2653]

University of Belgrade - Faculty of Transport and Traffic Engineering, Belgrade, Srebia

Abstract:

Successful resources planning of residential Gigabit network requires identifying users profiles at first. The assessment of network capacity requirements within a user profile can differ depending on the application categories. The accuracy of the user profile based on how the user information is gathered and organized. This research will be conducted through the methodology of the Digital Economy and Society Index (DESI) after 2021, as well as the introduction of the Europe's Digital Decade based on the availability of data suitable for use as market indicators for several Western Balkan countries regarding application categories. This review is significant for updating the guidelines used for developing the Next Generation Access market potential indicators, as well as demand forecasting, taking into account the result of the similar research.

Keywords:

Digital Decade, DESI, Market Potential, NGA Model, Data Sources.

INTRODUCTION

The huge changes in the world over the past few years, triggered by the emergence of the COVID-19 pandemic, as well as the other global crises, have resulted in shifts of labour mobility trends, transfer to the digital services, remote work, and automation of certain business processes. These changes have notably impacted the transformation of the internet resources utilization, specifically in terms of traffic demand across residential and business users. Accordingly, forecasting models based on the broadband market potential should reflect changes in demographic structures and user habits regarding the use of various internet & multimedia applications in daily life.

The research conducted by the authors focuses on developing a new model for the Next Generation Access (NGA) market potential, applicable to certain Western Balkans countries where data collection for the model's development is feasible. Hence, this paper aims to analyse the impact of changes in data sources, which are inducted by the integration of DESI into the Digital Decade structure, as well as their impact to NGA market potential indicators. The paper compares research results with findings presented at [1].

Correspondence:
Slobodan Mitrović

e-mail:
s.mitrovic@sf.bg.ac.rs

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The remainder of the paper is structured as follows: Chapter 2 offers a brief overview of changes related to DESI role within the Digital Decade policy program 2030. Section 3 proposes changes to data sources for NGA market potential indicators and discusses the availability of relevant market indicators for Western Balkan countries in the scope of abovementioned changes. Finally, the paper is concluded in Section 4.

2. DESI AND DIGITAL COMPASS 2030

Since 2014, the European Commission has been monitoring the digital progress of member states and annually releases reports on the Digital Economy and Society Index (DESI). It is a composite index that has a three-level structure, consisted of several dimensions, sub-dimensions and indicators which are results of the assessments of various aspects of digitalization in EU countries. Those aspects are carefully selected to reflect key trends and developments in the digital economy and society during the periods of interest. With the fact that DESI index should be consisted if several dozen indicators, which data should be collected in at least 28 EU member countries (and other countries, which are candidates to be EU members, as well), there is a complex task of data harvesting in order to create useful datasets. Typically, the majority of data is gathered through the Eurostat, while other broadband indicators are collected by the services of the European Commission from the Member States through the Communications Committee, as well as studies prepared for the Commission [2]. More detailed information about sources are published in DESI reports and methodological notes at the annual level. It must be noted that methodology of DESI index composition is not constant – it is changing with the interest to give the best overview of the progress of reaching the given targets related EU Member States on their digital development. In the Western Balkans (WB) area a contribution to the similar task is given in WB DESI reports like [3].

Having this in mind, during the 2014-2020, the DESI methodology covered five principal policy areas (Connectivity, Human Capital, Use of Internet Services, Integration of Digital Technology and Digital Public Service), which were positioned as dimensions and covered 37 indicators overall [4]. In 2021, the European Commission proposed the Digital Decade is a part of the 2030 Digital Compass [5], a long-term strategy on the digital transformation of the European Union that should include to reach achievements in all identified digital areas: Artificial Intelligence, Cybersecurity, Internet of Things, Big Data, High Performance Computing, 5G, Software and Digital skills. In order to keep track on the progress regarding identified targets, the DESI is set to be a part of the cooperation mechanism for shaping EU digital transformation within the Digital Decade. Along with the establishment of the Digital Decade Policy Programme, a new methodology for DESI calculation was applied to measure progress towards each of the 2030 targets [6].To harmonize DESI with the 2030 Digital Compass goals and enhance methodology considering recent technological and political advancements, significant changes were made in the 2021 report edition. DESI now aligns with the four main areas outlined in the Digital Compass, replacing the previous five-dimensional structure. Hence, there are 4 new dimensions (Digital skills, Digital infrastructures, Digital transformation of businesses and Digitalisation of public services) with updated 30 indicators overall [7]. Also, DESI annual reports changed the default form and now they could be found in digital form as Digital Decade DESI visualisation tool [8]. As a new feature, DESI incorporates an indicator for the level of support provided by adopted ICT technologies for eco-friendly measures (ICT for eco-sustainability) and gigabit services usage. It also includes the percentage of companies offering training and utilizing ICT e-invoicing. Previous DESI results and rankings were recalculated for all countries to reflect changes in indicator selection and corrections in underlying data, in order to maintain relevant time series.

3. 2030 DIGITAL COMPASS: A NEED FOR NGA BROADBAND MARKET POTENTIAL INDICATORS ADAPTATION IN WB COUNTRIES

As stated in [1], the starting point for the NGA market potential model, which should be applicable for the WB area, is the WIK model [9]. According to this model, the assessment of network capacity requirements is based on user behaviour. Therefore, the model relies on user applications, which were classified according their bandwidth requirements. Due to such a criteria [1] and [9], the applications were grouped into the 11 categories. For the purpose of this research, this classification is named WB NGA model 2022, (Figure 1). Considering the poor availability of data sources for certain categories, as well as their applicability for the WB area, it was observed that certain categories of applications need to be regrouped.

Therefore, a modification of the market potential model (WB NGA model 2024) is proposed in order to solve the addressed problem with introducing the following changes (Figure 1):

First, the use of streaming platforms with HD, 3D, 4K, 8K and other formats is combined into one category. In similar way, the communication and video communication categories are also combined into one category, taking into account the possibility that video communication can be turned on or off during a single session on existing platforms. The reason for the proposed change is based on the fact that the available data sources (regardless of whether they belong to local agencies or Eurostat) are not classified satisfactory in a way that would correspond to the WB NGA 2022 model. Additionally, the sources of datasets have changed significantly because of the modifications in the DESI methodology due to the integration of DESI into the Europe's Digital Decade. Such circumstances caused data sources to be changed in two ways - in their number and in relation to certain DESI dimensions. Based on these facts, the following changes in the structure of data sources were proposed, both by application classification and by individual WB countries:

1. Basic internet: no significant changes are proposed, except in the case of Serbia, where the change the DESI 2020 indicators (1b1 and 1b2) to DESI 2023 indicators (2b1 and 2b2), is recommended respectively, due to the structure of dimensions change;
2. Home office/VPN: changing the DESI dimension structure eliminates the need for the following data sources:
    a. Bosnia and Herzegovina: BHAS sources related to DESI 2020 indicators 3b4 and 3c3;
    b. Montenegro: MONSTAT sources related to DESI 2020 indicators 3b4 and 3c3, while the sources that are related to DESI 2023 4a3 indicator remain;
    c. Serbia: use of I-DESI 2020 indicators 3b4 and 3c3, while sources related to DESI 2023 4a3 indicator remain;
3. Cloud Computing:
    a. Albania: sources equivalent to the DESI 2023 3b1 indicator remain;
    b. Bosnia and Herzegovina: sources that are equivalent to DESI 2023 3b1, 3b4, 3c1, 3c2 and 3c3 indicators remain;
    c. Serbia: sources that are equivalent to DESI 2023 3b1, 3b4, 3c1, 3c2 and 3c3 indicators remain;
4. State of the Art and Progressive Media and Entertainment (4K, 3D, HD, 8K, VR/AR): For all observed WB countries, the primary source Eurostat is proposed for: ISOC_CI_AC_I datasets (I_IUV, I_IUVOD, I_IUSTW indicators), as well as for ISOC_EC_IBGS datasets, where data sources of indicators I_BMUSS, I_BFLMS are available as follows:
    a. Albania: for 2021 and 2022, as well as the secondary source: INSTAT reports;
    b. Bosnia and Herzegovina: for 2021 and 2023, as well as the secondary source: BHAS reports;
    c. Montenegro: for all years;
    d. North Macedonia: for 2021, as well as the secondary sources: MAKStat, AEK Annual Report;
    e. Serbia: for all years, while the need for sources related to DESI 2020 indicators 3b2 and 3b3 is ceased;

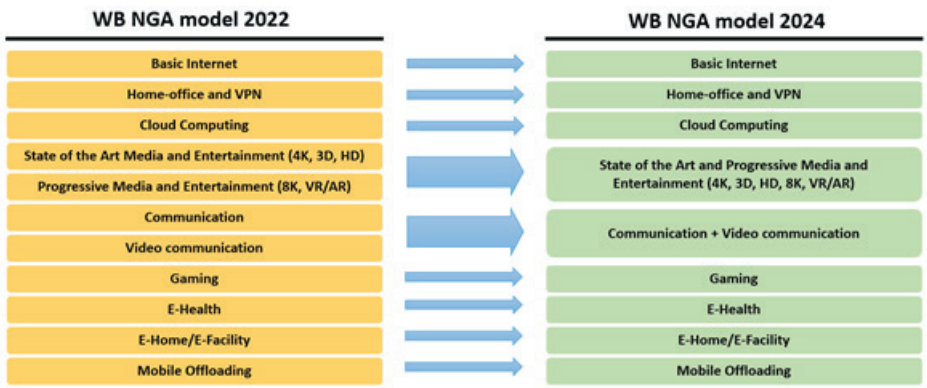

Figure 1. Application differences between proposed WB NGA models.

5. Communication + Video communication: for all observed WB countries, the primary source Eurostat is proposed for: ISOC_EC_CE_I dataset (I_BANY_PP indicator for 2021 and 2022), as well as for ISOC_CI_AC_I datasets, where data sources of indicators I_IUPH1, I_IUOLC are available as follows:
   a. Albania: for 2021 and 2022, as well as the secondary source: INSTAT reports;
   b. Bosnia and Herzegovina: for 2021 and 2023, as well as the secondary source: BHAS reports;
   c. Montenegro: for 2021 and 2022, as well as the secondary source: EKIP reports;
   d. North Macedonia: for 2021, as well as the secondary recommended source: MAKStat;
   e. Serbia: for all years, as well as the secondary source for I_BANY_PP: RZS, while the need for sources related to DESI 2020 indicators 3b4 and 3b5 is ceased;
6. Gaming: instead of the sources related to 2020, a new source [10] is recommended;
7. E-Health: for all WB countries the same recommendation remains as in [1]
8. E-Home / E-Facility: for all WB countries, except in the case of Serbia and Albania, the same recommendation remains as in [1].

   In the case of Serbia, a data source related to DESI 2023 indicators 3b4 and 3b5 is recommended, while in the case of Albania, a potential lack of data was observed;
9. Mobile Offloading: for all countries, a potential lack of data is still observed, well as in the case of WB NGA 2022, findings [11] are recommended.

Like in [1], the data source analysis results are presented in Table 1 for each of observed WB countries. In order to make these tables as compatible as possible, the most of the notational rules are used in the same way. There are a few more, which are mostly relevant to datasets established after 2020. All notations are presented in Table 2.

Table 1. Modified data sources in accordance o WB NGA 2024 model.

	Country				
Indicator	**Albania**	**Bosnia and Herzegovina**	**Montenegro**	**North Macedonia**	**Serbia**
Basic Internet	AKEP (Annual Reports), INSTAT Reports	RAK (Annual Report, items 35-40) <*1><!>, Eurostat: ISOC_CI_IFP_IU	EKIP	AEK Annual Report, BCO (Connectivity indicators in DESI aligned format), MAKStat	DESI (2b1,2b2)
Home office/VPN	Eurostat: ISOC_IW_HEM (I_WHDAY <*2>), INSTAT Reports	Eurostat: ISOC_IW_HEM (I_WHDAY<*2>) ISOC_EC_IBOS, ISOC_EC_CE_I <*3>	MONSTAT reports (4a3<*1> <*3>), Eurostat: ISOC_IW_HEM (I_WHDAY <*2>), ISOC_EC_IBOS, ISOC_EC_CE_I <*3>	MAKStat, Eurostat: ISOC_EC_IBOS, ISOC_EC_CE_I <*3>	DESI (4a4 <*1>) Eurostat: ISOC_IW_HEM (I_WHDAY) <*2> ISOC_EC_IBOS, ISOC_EC_CE_I <*3>
Cloud Computing	INSTAT Reports (3b1 equivalent only <*3>), Eurostat: ISOC_CICCI_USE (2018, 2019 <!>)	BHAS Report <!> (3b1, 3b4, 3c1, 3c2, 3c3 equivalents <*3>), ISOC_CICCI_USE (2018-2020 <!>)	Eurostat: ISOC_CICCI_USE <*4>, ISOC_CI_AC_I<*1>	MAKStat, Eurostat: ISOC_CICCI_USE <*4>, ISOC_CI_AC_I	DESI (3b1,3b3,3b4,3c1, 3c2,3c3<*1>), Eurostat: ISOC_CICCI_USE <!>, ISOC_CI_AC_I
State of the Art Media and Entertainment (4k, 3D, HD)… + Progressive Media and Entertainment (8k, …)	Eurostat: ISOC_CI_AC_I: I_IUV, I_IUVOD, I_IUSTW ISOC_EC_IBGS: I_BMUSS, I_BFLMS (<*3>:2021,2022), INSTAT reports	Eurostat: ISOC_CI_AC_I: I_IUV, I_IUVOD, I_IUSTW ISOC_EC_IBGS: I_BMUSS, I_BFLMS (<*3>:2021,2023), BHAS reports	Eurostat: ISOC_CI_AC_I: I_IUV, I_IUVOD, I_IUSTW ISOC_EC_IBGS: I_BMUSS, I_BFLMS, EKIP reports	Eurostat: ISOC_CI_AC_I: I_IUV, I_IUVOD, I_IUSTW ISOC_EC_IBGS: I_BMUSS, I_BFLMS (<*3>:2021), MAKStat, AEK Annual Report*	Eurostat: ISOC_CI_AC_I: I_IUV, I_IUVOD, I_IUSTW ISOC_EC_IBGS: I_BMUSS, I_BFLMS

Indicator	Country				
	Albania	Bosnia and Herzegovina	Montenegro	North Macedonia	Serbia
Communication + Video Communication (HD)	Eurostat: ISOC_EC_CE_I: I_BANY_PP (<*5>:2021,2022), ISOC_CI_AC_I: I_IUPH1, I_IUOLC (<*5>:2021,2022), INSTAT reports	Eurostat: ISOC_EC_CE_I: I_BANY_PP (<*5>:2021,2022), ISOC_CI_AC_I: I_IUPH1, I_IUOLC (<*5>:2021,2023), BHAS reports	Eurostat: ISOC_EC_CE_I: I_BANY_PP (<*5>:2021,2022), ISOC_CI_AC_I: I_IUPH1, I_IUOLC (<*5>:2021,2022), EKIP reports	Eurostat: ISOC_EC_CE_I: I_BANY_PP (<*5>:2021,2022), ISOC_CI_AC_I: I_IUPH1, I_IUOLC (<*5>:2021), MAKStat reports <!>	Eurostat: ISOC_EC_CE_I: I_BANY_PP (<*5>:2021,2022), ISOC_CI_AC_I: I_IUPH1, I_IUOLC , RZS reports
Gaming	[10]	[10]	[10]	[10]	[10]
E-Health	ISOC_CI_AC_I <!>	BHAS report <!>, ISOC_CI_AC_I <!>	EKIP <!>, ISOC_CI_AC_I <!>	MAKStat, ISOC_CI_AC_I <!>	ISOC_CI_AC_I <!>
E-Home / E-Facility	/	BHAS report <!>	EKIP <!>	AEK Annual Report<*1>	DESI (3b4, 3b5<*1>)
Mobile Offloading	/	/	/	/	/

Table 2. Notations related to the data source application to WB NGA 2024 model.

Notation sign	Meaning
<!>	Local WB sources are still proposed to be revised and enriched with some additional data, for all datasets published before 2020 while time series in last 4 years could be obtained from the proposed Eurostat dataset.
<*1>	Local or DESI2023 datasets and sources, which are proposed to be adopted as the data source.
<*2>	Datasets which were published in 2018 only.
<*3>	Data published in 2020 onwards.
<*4>	Datasets proposed to be used for the purposes of enriching time series before 2020.
<*5>	Eurostat datasets proposed to be used.

4. CONCLUSION

The European Commission has continuously adapted the Digital Economy and Society Index methodology to reflect evolving digital trends and policy priorities. Initially structured around five principal policy areas, DESI underwent significant changes in 2021 to align with the Digital Decade goals, incorporating four main areas outlined to be groups of indicators, which make clear connection with associated KPI targets. Therefore, it was highly recommended to make an assessment of the related data sources in order to keep track of the accuracy of the NGA market potential indicators that could be applied in the residential markets of the observed Western Balkan Countries. The analysis showed that there is a significant change on the data sources, comparing the finding made in 2022, identifying the need for the alignment with new DESI indicators, as well as the change of the structure of observed user applications. One of the most significant findings is the gaming population statistics identification that was previously identified as one of major challenges, considering the lack of appropriate data sources. Yet, the lack of the appropriate data sources regarding mobile offloading still remains the challenge in the future work, as ongoing effort to keep the track for the Digital transformation especially for those EU member candidate countries, which are on the way align their digital agenda with the 2030 Digital Decade targets.

5. ACKNOWLEDGEMENTS

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