INNOVATIVE SUSCEPTIBILITY IN THE CONDITIONS OF UKRAINE DIGITAL INFRASTRUCTURE DEVELOPMENT

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Abstract
Objective. The objective of the article is to evaluate the status and prospects of digital infrastructure development as a necessary condition for increasing the innovative susceptibility of Ukrainian regions.
Methodology. Theoretical and methodological basis of the research is the fundamental work of foreign and domestic scientists on innovative susceptibility, formation and development of digital economy and digitalization of society. Methods of analysis and synthesis (to determine the nature and basic components of digital infrastructure and highlight the main factors affecting the uneven development of digitalization in the regions of Ukraine), graphical method (to illustrate the dynamics of the share of households by regions having access to Internet services at home in 2010-2017), a method of comparison (to estimate population distribution across Ukrainian regions for the purpose of using Internet services in 2017).
Results. The need for the development of broadband networks in order to overcome the "digital divide" among the population in some regions, cities and villages is proved. The essence and basic components of digital infrastructure are considered. The distribution of population by regions of Ukraine in relation to the purpose of using Internet services in 2017 is analysed. The main factors influencing the uneven development of digitalisation in the regions of Ukraine and thus holding back the growth of their innovative susceptibility are defined, such as: lack of financial; problems that are supported for cyclical economies (necessary mailings used by average standards, adjustments to the regular program); use of "digital divide" and "digital inequality", imperfect inclusive work for residents of urban and vulnerable consumer groups; lack of motivation regarding information about the amount of digital data that was previously available; digital infrastructure is needed and accessible; displays new regulatory governance for the widespread legal regime for the emergence and development of digital technologies.
Conclusions. Overall, high-performance nationwide and regional digital infrastructure has enormous potential to promote economic and innovation growth, new socio-economic phenomena, new quality of life, and innovative innovation.

Keywords: digital economy, digital infrastructure, broadband networks, innovative susceptibility.

INTRODUCTION

Digital innovation began to spread in the world since the 1960s. The first stage of the development of digital innovation technology came down to the automation of existing technologies and business processes. The second stage started in the mid-1990s and was characterised by the global penetration of the Internet and mobile connection into human life. Currently, the development of technological infrastructure and using large databases have led not only to the extended access to the Internet of millions of consumers but also to the integration of a wide range of digital services, products and systems into a single cyber physical system [1].

The recognition of the digital economy importance is the annual increase of its share of GDP in the world by almost 18%, and in developed countries – by 7%.

According to the World Bank, a 10% increase in the number of high-speed Internet users can increase the annual GDP growth from 0.4 to 1.4% [3].

One of the promising directions for improving the efficiency of innovative development of Ukraine and its regions can be to support their competitiveness, taking into account the need and susceptibility of innovation by the society [8]. In the digital economy, when innovations are most often getting digital, the public's susceptibility of innovation depends on the availability of a high-quality Internet access, i.e. on the development of the digital infrastructure.

PREVIOUS RELATED RESEARCH

Some value in considering the issues of origin and development of digital economy, digitalisation of society is presented in the works of domestic and foreign scientists, in particular W.Isaacson, D. Bell, E. Williams, B. Gates, G. Karcheva, S. Kolyadenko, R. Lipsey, J. Von Neumann, E. Peters, E. Toffler, V. Fischuk, S. Huntington, and others.

Despite the abundance of research with different approaches to the development of the digital economy and information and communication technologies, their impact on the economic and innovation growth, the issue of digital infrastructure and its impact on innovation susceptibility in Ukraine as a whole and in its regions in particular need further study.

Stating the objective of the study. The objective of this study is to evaluate the status and prospects of digital infrastructure development as a necessary condition for increasing the innovative susceptibility of Ukrainian regions.

RESEARCH RESULTS AND DISCUSSION

In early 2018, the Concept of Digital Economy and Society Development of Ukraine for 2018-2020 was adopted in Ukraine [6]. According to this Concept, the creation of digital infrastructures is a major factor in increasing citizens' access to the global information environment and knowledge. The main objective of the digital infrastructure development is to ensure that all citizens of Ukraine, without restrictions and technical, organisational and financial constraints (including socially vulnerable groups), can take advantage of digital opportunities, regardless of their location or residence, and not be in the digital divide [6].

The Concept mentions National Broadband Internet Development Plan, which should define coverage models, models and mechanisms for intensifying the investment activity of market operators, as well as mechanisms for creating demand and forming citizens' needs to obtain broadband Internet access services.

Demand for high speed Internet is increasing worldwide. Needs of society are changing. The use of fixed and mobile digital devices, the learning process with digital devices, medical video services, interaction with government agencies, the use of various applications and automated systems, etc., is increasingly affecting the volume and speed of data transmission. In December 2018, the International Telecommunication Union (ITU) announced that 3.9 billion people or 51.2% of the world's population use the Internet.

In Europe, 79.6% of the population had access to the Internet at the end of 2018. EU leaders are linking the future with technological changes, which is the beginning of the digital era – the introduction of the achievements of the 4th Industrial Revolution in the regions and the entry into a period of steady growth [7, p. 24]. For example, the strategy "Europe 2020" [4] envisages the implementation of "The Plan of Digital Technologies Development in Europe". The goals of this plan are to achieve a sustainable economy and social benefits through the creation of an EU-wide digital market based on the broadband Internet.

Speaking of Ukraine, about 60% of Ukrainians currently use the Internet on a regular basis, with even fewer users having access to the high speed Internet. The state of the broadband Internet in Ukraine indicates that there are some disproportions in the penetration of the broadband Internet by regions (Figure 1) and a fairly noticeable gap between the city and the village – about 30%.

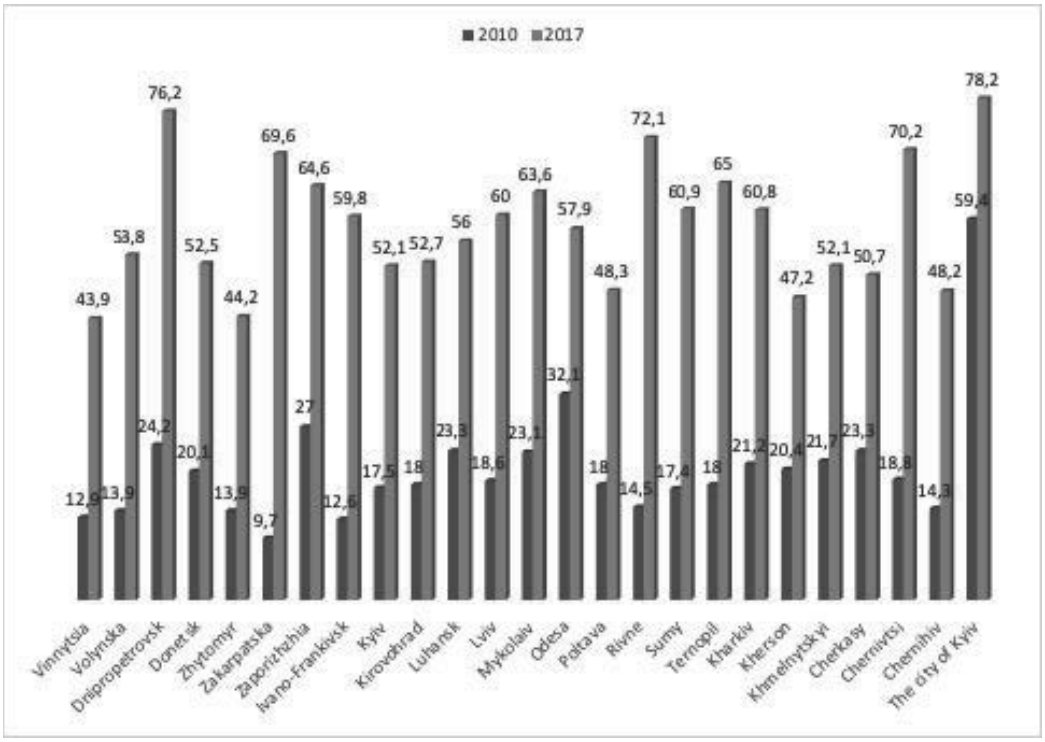

Figure 1. Dynamics of the share of households by regions with the access to Internet services at home for 2010-2017

Source: compiled by the author according to [2]

For example, a significant number of rural population (33-35%) do not have the broadband Internet, but could connect to it. However, studies show that for vulnerable consumer groups, such as low-income families, retired and disabled

people with low-income, the broadband Internet is not accessible at all, regardless of a city or a town.

The main reason for this is technical barriers, namely the lack of connectivity, i.e. there is a gap between the demand and the technical supply of the broadband connection. Due to the development of digital infrastructure in rural areas, the broadband indicators of the city and the countryside can almost get equal.

Therefore, the basis of digital economy development is a developed digital infrastructure. At present, there is no comprehensive research on the status and strategy of digital infrastructures development in Ukraine, the digital infrastructure in Ukraine is traditionally restricted only by telecommunications. However, in a general sense, digital infrastructure is not just telecommunications, it is a complex of technologies, products and processes that provide computing, telecommunication and networking possibilities and operate on a digital (rather than analog) basis [5].

At the national level, digital infrastructure is divided into hard and soft (Figure 2).

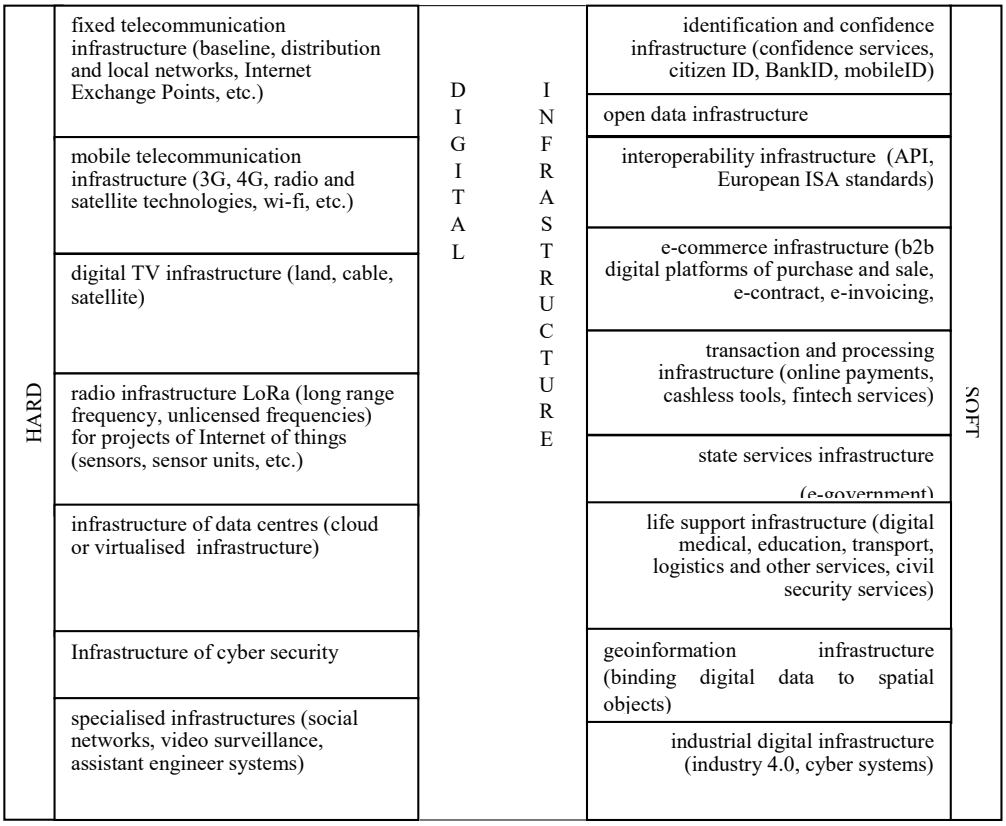

Figure 2. Basic components of digital infrastructure

Source: developed by the author according to [5]

Each contains relevant components that separately and together contribute to the economic growth of the country and the regions. The loss of one or more

infrastructure components reduces the pace and quality of digitization of the economy and society.

All the components of the national digital infrastructure are key ones to digital transformation of the economy and life activity, that is, it is the basis for many digital applications, services and implementation of digital platforms.

Digital infrastructures are bridges that contribute to the open, intelligent and integrated access to the vast amount of data available today and to taking full advantage of its potential, opening up new possibilities for research and innovation. The digital infrastructure is necessary to make progress in major areas of digital transformation, such as the Internet of Things (IoT), "Industry 4.0", network mobility or cloud services. It enables the automatic and decentralised exchange of information between machines, devices and sensors ("machine-machine" or "M2M"), which, in its turn, is the basis for a virtual network, for managing largely autonomous processes of production and maintenance in "smart" systems in the near future.

The underdeveloped digital infrastructure reduces the ability of households to benefit from digital transformation and, as noted above, especially in rural areas (home office work, digital administration, healthcare, educational services, etc.).

The distribution of population by regions of Ukraine for the purpose of using Internet services in 2017 is shown in Table 1.

Table 1. Population distribution by regions of Ukraine for the purpose of using Internet services in 2017

Regions	Population, thous. pers	Using I-net service, thous. pers	Purpose of using Internet services (% of population, that have stated, that they have used Internet services)												
			M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13
Vinnytsia	1566,7	797,0	25,2	3,5	36,0	25,9	62,3	31,8	7,1	48,7	54,3	20,7	31,8	22,0	0,5
Volynska	1021,5	505,4	31,4	0,4	24,7	42,2	70,4	47,3	0,6	30,9	31,1	7,4	22,9	14,9	14,3
Dnipropetrovsk	3216,9	2360,0	22,5	3,3	32,0	26,8	62,2	45,1	7,1	43,3	48,2	21,9	30,8	14,4	15,6
Donetsk	2169,8	1194,2	21,4	2,3	26,4	24,2	65,8	37,4	4,8	57,2	43,1	15,5	27,8	21,1	21,6
Zhytomyr	1225,6	623,0	15,3	2,0	35,5	22,7	42,8	38,2	1,6	29,1	39,2	4,4	28,8	10,8	17,0
Zakarpatska	1237,8	773,1	7,6	-	26,1	19,3	65,6	49,2	1,4	56,8	66,5	5,9	36,7	11,3	34,1
Zaporizhzhia	1755,9	1106,2	25,2	1,8	25,1	19,9	65,4	43,3	4,5	52,6	52,4	9,3	27,3	18,3	33,8
Ivano-Frankivsk	1352,8	874,6	13,6	-	29,4	19,5	68,1	44,6	3,9	74,8	65,0	16,3	19,7	6,9	24,0
Kyiv	1719,2	919,3	18,9	0,9	20,5	26,5	51,0	30,4	7,8	20,2	53,4	11,0	42,4	20,2	18,6
Kirovohrad	955,4	511,1	24,8	2,5	24,8	16,5	70,2	39,2	3,5	40,2	58,7	10,4	42,8	24,1	19,2
Luhansk	803,1	416,1	19,0	2,1	25,4	24,2	66,9	24,5	2,8	53,2	40,4	15,0	31,2	29,8	19,9
Lviv	2480,6	1395,2	21,8	1,0	28,2	30,3	64,6	35,8	2,0	54,6	49,8	7,3	26,3	21,4	25,5
Mykolaiv	1132,2	679,2	5,8	-	28,7	32,3	67,2	33,1	4,9	52,1	29,6	15,5	31,4	19,2	18,5
Odesa	2349,8	1156,5	32,0	1,6	23,8	17,8	66,0	37,9	5,9	52,0	50,4	10,5	41,1	15,4	25,4
Poltava	1406,0	755,6	21,6	3,3	23,1	29,4	40,4	39,6	3,5	40,0	48,4	16,1	40,4	29,3	10,7
Rivne	1143,3	614,7	21,3	1,1	26,9	17,1	61,0	42,3	6,8	45,0	38,8	4,2	18,4	11,8	11,8
Sumy	1085,0	648,4	14,5	-	20,0	34,4	71,6	35,8	1,3	32,1	40,7	18,4	38,4	11,8	24,3
Ternopil	1041,8	633,7	27,9	0,5	29,2	33,4	58,0	25,9	1,3	61,8	41,6	7,0	23,5	8,9	25,7
Kharkiv	2706,0	1682,0	25,5	0,7	27,5	27,2	55,8	40,3	9,0	51,7	58,2	15,4	47,2	11,2	19,4
Kherson	1049,4	522,3	27,5	2,9	27,7	22,7	60,0	31,9	7,9	54,0	52,2	21,1	32,0	11,4	15,5
Khmelnytskyi	1261,8	754,7	14,5	1,0	29,5	21,9	65,2	37,8	5,4	52,6	50,3	9,1	31,3	15,2	9,5
Cherkasy	1221,7	637,0	17,0	3,6	31,6	33,5	73,7	32,0	2,3	38,1	50,5	8,0	29,0	21,5	23,5
Chernivtsi	890,4	602,3	10,3	2,6	29,9	16,6	57,0	36,0	2,7	57,3	47,8	5,1	33,4	12,5	13,2
Chernihiv	1012,1	525,1	22,7	2,8	30,1	11,4	63,4	35,8	6,8	35,6	53,9	14,4	28,0	17,5	17,9
The city of Kyiv	3893,1	2102,3	44,9	3,8	30,1	28,2	54,9	21,3	7,4	48,3	52,9	22,7	37,4	16,0	23,3

where M1 is sending (receiving) e-mail;
M2 is interaction with public authorities (e-government system) - downloading / requesting forms, filling in / submitting forms online, making online payments to government institutions and purchasing from them;

M3 is educational purposes. It refers to the purposes of formal education, such as research related to school and higher education courses, as well as distance education, including online activities;
M4 is reading / downloading newspapers, magazines online - reading/ downloading newspapers, magazines, eBooks online, subscribing to online news services, access to news websites for a fee and free;
M5 is downloading movies, images, music; watching TV or video or listening to the radio or music – public access to files and using web radio or web TV both for a fee and free;
M6 is playing video or computer games or downloading them- games that enable public access to files, online games both for a fee and free;
M7 is software downloading - downloading patch files or updates, both for a fee and for free;
M8 is telephone calls via Internet / Volp (Skype, iTalk, via webcam);
M9 is communication (hobby) - including posting messages or other information on chat sites, blogs, newsgroups, online discussion forums or similar resources, use of instant messaging;
M10 is banking - electronic transactions with the bank for payments, transfers, etc. or a review of the account information. Electronic transactions are not included in other financial services, such as stock purchases, insurance;
M11 is a search for health related information (medicines, medical services, pieces of advice, etc.) for yourself as well as others - including trauma, illness, nutrition and health improvement information ;
M12 is ordering (purchase) of goods and services - refers to orders for the purchase of goods and services placed on the Internet, e.g. the purchase of products such as music, tours and housing rent. Cancelled or not completed orders are not included.
M13 is getting information about products and services not previously mentioned.

Source: developed by the author on the basis of [2]

Despite the fact that there is a significant inequality in the distribution of the share of the population for the purpose of using the Internet in some regions of Ukraine, the purpose that has the highest percentage (from 42.8% in Zhytomyr region to 73.7% in the Cherkasy region) among the surveyed population is watching television or video, downloading movies, images, music, etc. A large percentage of all regions also have other entertainment purposes: online computer games or downloading them; negotiations via the Internet; communication in chats, blogs, forums, etc.

The smallest share (from 0.4% in Volyn region to 3.8% in Kyiv) has the use of the Internet for the purpose of interaction with state institutions, and the population of four regions (Transcarpathian, Ivano-Frankivsk, Mykolaiv and Sumy) did not use eGovernment system in 2017 at all.

The main factors influencing the uneven development of digitalisation in the regions of Ukraine should be considered:

– lack of funding;

– the problem of training qualified personnel for the digital economy (the need to develop appropriate educational standards, adjust educational programs, etc.);

– the presence of “digital divide” and “digital inequality”, the incompleteness of inclusive policies for urban dwellers and vulnerable consumer groups;

– insufficient motivation of the society for the use of digital means, including financial;

– development of high-quality and accessible digital infrastructure;

– the slow formation of a new regulatory environment to ensure a favorable legal regime for the emergence and development of digital technologies.

CONCLUSION

In general, high-performance nationwide and regional digital infrastructure has enormous potential to promote economic and innovation growth, new social and economic phenomena, new quality of life, and innovative susceptibility.

REFERENCE

1. C. Cagnin, A. Havas, and O. Saritas (2013). Future-oriented technology analysis: its potential to address disruptive transformations, Technological Forecasting and Social Change, Vol. 80, pp. 379–385.
2. State Statistics Service of Ukraine [Online]. – Available at: http://www.ukrstat.gov.ua
3. World Development Report 2016: Digital Dividends. World Bank Review [Online]. – Available at: http://www.inesnet.ru/wp-content/uploads/2016/01/World0developm0l0dividends0overview.pdf
4. EUROPE 2020. A European strategy for smart, sustainable and inclusive growth [Online]. – Available at: http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf
5. Fishchuk V. Digital infrastructure of economic growth [Online]. – Available at: https://biz.nv.ua/ukr/experts/tsifrova-infrastruktura-ekonomichnogo-zrostannja-1408403.html
6. Concept of Digital Economy and Society Development of Ukraine for 2018-2020. Action Plan for the implementation of the Concept of Digital Economy and Society Development of Ukraine for 2018-2020 [Online]. – Available at: https://www.kmu.gov.ua/storage/app/uploads/public/5a7/c21/c86/5a7c21c867bde621479479.doc
7. Startup investment & Innovation in emerging Europe. A research study by East-West Digital News (2018) [Online]. – Available at: http://cee.ewdn.com

Yermak S.O. (2019). Assessment of innovative susceptibility of Ukrainian regions, Problems of System Approach in Economy, No.1 (69), Iss.2, pp. 41–47.