FETDE 2020
International Conference on Finance, Entrepreneurship and Technologies in Digital Economy

ASSESSMENT OF RUSSIA'S COMPARATIVE ADVANTAGES IN THE WORLD MARKET OF DIGITAL ECONOMY

Konstantin B. Kostin (a)*, Anastasia A. Berezovska (b)
*Corresponding author

(a) University of North Florida, Faculty of Economics and Finance, Saint-Petersburg State University of Economics, Sadovaya str. 21, office 2094 St. Petersburg, Russia, kost_kos@mail.ru
(b) Saint-Petersburg State University of Economics, Sadovaya str. 21, office 2094 St. Petersburg, Russia, aaberezovska@gmail.com

Abstract

This study examines the development and functioning of the digital economy as a tool for creating a country's competitive advantage in the global market. The article defines the basic concepts of the digital economy, analyzes its essence, and defines the relationship between high-tech industries and the digital economy. The methodology was proposed for assessing the development of the country's digital economy, based on the theory of comparative advantages of countries. Relevant mathematical framework was proposed for assessing the country's comparative advantages in the field of the digital economy. The testing of proposed methodology for assessing the development of the digital economy was carried out via performing comparative analysis of the digitalization level in the Russian Federation and the leading countries in terms of GDP (PPP). Based on the analysis, we conclude that there is a need to develop the digital economy both in Russia to achieve new competitive advantages, and for other countries.

2357-1330 © 2021 Published by European Publisher.

Keywords: The digital economy, high-tech industries, competitive advantages of countries, comparative advantage, digital technologies

1. Introduction

The current state of development of the global economy is associated with increased mobility, the flexibility of economic resources, and the transformation of traditional aspects of the economic system into a digital economy. This leads to the emergence of the information society (Dyatlov, 1995) and the formation of competitive advantages. The country's competitiveness in the world market and the degree of its integration into the world economy depends on the efficiency of enterprises (Kostin & Berezovskaya, 2019).

Their activities are characterized by the deployment of a new technological wave - the fourth industrial revolution (Schwab, 2016). The connection between high-tech industries and the digital economy increases the relevance of the development of high-tech enterprises in order to adapt the business sector to a changing digital environment (Kostin & Berezovskaya, 2017).

2. Theoretical review

The digitalization of the economy is considered as a key driver of innovation, economic growth and societal change (Afonasova et al., 2018). The main feature of the digital economy is its key production factor – the digital data (can be expressed as big data see for example: (Trofimov & Trofimova, 2018).

From the point of view of the socio-economic space, the digital economy is an economy whose main goal of development is to improve the quality of life of the population by reducing the cost of living, the emergence of new opportunities for the development of human potential, and the expansion of the accessible environment for people with disabilities. Accordingly, the digital economy presents new requirements for a person, such as the ability to work with information and communication technologies, use the new capabilities of the digital space for professional and personal needs (Bakumenko & Kostromina, 2018).

Therefore, quite often the digital economy appears to a greater extent as a non-economic phenomenon related to the production of goods based on the use of digital technologies in scientific studies (Zaitsev, 2019).

The digital economy in the narrow sense is that part of the economy that is represented by companies working primarily with digital technologies and whose business model is based on digital products or services. This sector consists of the digital sector itself, together with promising digital services and platform services (Bucht & Hicks, 2018).

The analysis of international experience revealed that, despite the obviously increasing role of the internet sector of the economy, there is still no universally accepted methodology for measuring it (Plaksin et al., 2017).

3. Methodology

The need for an objective analysis of the functioning of the digital economy is determined not only by the degree of prospects of investments in the transformation of its activities from the traditional sector into the digital one, but also by the very dynamism of economic development in the neural network era

(Kostin & Berezovskaya, 2019a,b). Unfortunately, modern methods for relevant performance assessment do not cover the whole range of indicators of the development of the digital economy.

Therefore, the authors propose a valuation method, which includes a comprehensive analysis of such elements as the export of high-tech goods (in % of industrial exports), R&D expenses (in % of GDP), the level of countries' readiness for the digital economy, the level of ICT development by country, the e-government development index by country, global cybersecurity index by country, international index of digital economy and society by country.

While study was performed, the main sources of initial data were materials from articles published in journals indexed by the Scopus and Web of Science databases; analytical reports of international organizations; statistical and analytical materials published in official electronic resources.

The main research methods used in this article include: a systematic approach, retrospective and perspective analysis, heuristic and econometric modeling, and statistical experiment.

Comparative advantages of Russia relative to the countries displaying leading economic development are identified using the method of analysis of comparative advantages according to the Bela Ballass formula presented below (Balassa, 1965):

$$RCA_{ij} = \left(\left(\frac{x_{ij}}{x_i} \right) / x_{ai} / x_a \right) \tag{1}$$

where RCA_{ij} = coefficient of identified comparative advantages, x_{ij} – export of product j from country i, x_i – total exports from country i, x_{ai} – total export of product j from country a, x_a – total exports from country a.

The analysis is carried out by comparing the obtained indicators (calculations according to the Bela Ballas formula adapted to the needs of the analysis) with reference values (the value "> 1" - score "+1" the country under investigation has a comparative advantage above other countries; "= 1" - score "0" – the country's position is relatively average compared to other countries, "<1" - a score of "-1" – the country under investigation is at comparative disadvantage in comparison to other countries). The final level of development of the digital economy can range from -7 to +7.

4. Approbation

The proposed research methodology involves the calculation of comparative advantages using the Bela Ballas formula (initially the formula was used to determine comparative advantages and factors such as export of product j from country i, total export from country i, total export of product j from country a were used, total exports from country a). The indicators for the calculations are shown in table 1.

Table 1. Indicators for calculating the comparative advantages of Russia relative to leading countries in terms of GDR, 2015-2018

Indicators	Countries				
	RF	China	USA	India	Japan
GDP level (PPP), billion dollars (GDP, PPP, current prices (international dollars), per person, by PPP…, 2019)	4050.7	25361.7	20494.1	10498.4	5414.6
Country Rank by GDP	6	1	2	3	4

Export of high-tech goods (in % of industrial exports), 2017 (Export of high-tech goods, 2019)	12.5	30.9	19.7	7.4	17.6
R&D expenditures, in% of GDP, 2017 (R&D expenditure, 2019)	1.1	2.1	2.8	0.6 (2015)	3.2
Networked readiness index, 2016 (as cited in Networked readiness index, 2019)	5	4	6	4	6
ICT Development Index (IDI) values, 2017 (Measuring the Information Society Report – 2017, 2019)	7.07	5.6	8.18	3.03	8.43
Country E-Government Development Index, 2018 (United nations e-government survey – 2018. Gearing e-government to support transformation towards sustainable and resilient societies, 2019)	0.7969	0.6811	0.8769	0.5669	0.8783
Global Cybersecurity Index (GCI), 2018 (Global Cybersecurity Index (GCI) – 2018, 2019)	0.836	0.828	0.926	0.719	0.880
International Digital Economy and Society Index, I-DES, 2016 (United nations e-government survey – 2018. Gearing e-government to support transformation towards sustainable and resilient societies, 2019)	0.48	0.45	0.67	-	0.68

	Germany	Indonesia	Brazil	France	Great Britain
GDP level (PPP), billion dollars (GDP, PPP, current prices (international dollars), per person, by PPP, 2019) (GDP, PPP, current prices, 2019).	4456.1	3494.7	3365.7	3037.3	3024.5
Country Rank by GDP	5	7	8	9	10
Export of high-tech goods (in % of industrial exports), 2017 (Export of high-tech goods, 2019)	15.9	8.2	13.3	26.1	23
R&D expenditures, in% of GDP, 2017 (R&D expenditure, 2019)	3	0.2	1.3 (2016)	2.2	1.7
Networked readiness index, 2016 (as cited in Networked readiness index, 2019)	6	4	4	5	6
ICT Development Index (IDI) values, 2017 (Measuring the Information Society Report – 2017, 2019)	8.39	4.33	6.12	8.24	8.65
Country E-Government Development Index, 2018 (United nations e-government survey – 2018. Gearing e-government to support transformation towards sustainable and resilient societies, 2019)	0.8765	0.5258	0.7327	0.8790	0.8999
Global Cybersecurity Index (GCI), 2018 (Global Cybersecurity Index (GCI) – 2018, 2019)	0.849	0.776	0.577	0.918	0.931
International Digital Economy and Society Index, I-DES, 2016 (United nations e-government survey – 2018. Gearing e-government to support transformation towards sustainable and resilient societies, 2019)	0.64	-	0.4	0.62	0.73

Based on the data presented in the table 1, the comparative advantages of Russia in terms of: "Export of high-tech goods (in % of industrial exports), 2017" are calculated within the framework of the study. The analysis of comparative advantages is performed in accordance to the Bela Ballass formula (1) presented above.

Taking into consideration that the analysis is carried out not only in the "export" category, the maximum value for the analyzed indicator is substituted for the value replacing "export of the product from the country" (for example, China has the highest value for the "High-tech goods export" indicator (30.9 %), and it is this value that will be the denominator in the calculations. The Bela Ballass formula, adapted for the needs of analysis, will look like this:

$$AC\left(the\,comparative\,advantage\,of\,the\,country\right)=\frac{x_a}{x_{max}}\,/\,\frac{x_b}{x_{max}} \qquad (2)$$

where CAC – proposed coefficient representative of the comparative advantages of the country, x_a is the comparative indicator of the country a, x_{max} is the maximum comparative indicator of the country, x_b is the comparative indicator of the country b.

Assessment of comparative advantages (CAC "export of high-tech goods") of Russia was carried out on the basis of relevant comparison (based on corresponding variables) with an array of leading countries (China, USA, Japan, Germany, France, India, Indonesia, Brazil, Great Britain) (table 2). The green value in the table is correspondent of positive value, which will be taken as "+1" for further calculations, which means that Russia has a comparative advantage; yellow - "0", which means that Russia and the country with which the comparison was made are equal; and red - "-1", which means that Russia does not have a comparative advantage in relation to the country with which the comparison was made.

a). The indicators for the calculations are shown in table 1.

Table 2. Comparative advantages of Russia in the high tech goods export sector (created by authors)

Country	Export of high-tech goods,% of GDP	Calculation	Russia's comparative advantage
Russian Federation	12.5		
China	30.9	(12.5/30.9) / (30.9/30.9)	0.405
USA	19.7	(12.5/30.9) / (19.7/30.9)	0.635
India	7.4	(12.5/30.9) / (7.4/30.9)	1.689
Japan	17.6	(12.5/30.9) / (17.6/30.9)	0.710
Germany	15.9	(12.5/30.9) / (15.9/30.9)	0.786
Indonesia	8.2	(12.5/30.9) / (8.2/30.9)	1.524
Brazil	13.3	(12.5/30.9) / (13.3/30.9)	0.940
France	26.1	(12.5/30.9) / (26.1/30.9)	0.479
Great Britain	23	(12.5/30.9) / (23/30.9)	0.543

Based on the results of the identified indicators of Russia's comparative advantages in the high-tech goods export sector (table 2), it can be concluded that Russia has comparative advantages in relation to India and Indonesia, since the value of the CAC relative to these countries = "> 1".

Table 3 presents the comparative advantages of Russia relative to the selected countries according to the indicators proposed in table 1.

Table 3. Comparative advantages of the digital economy of Russia (created by authors)

Indicators	Comparative advantages of Russia relative to this country								
	China	USA	India	Japan	Germany	Indonesia	Brazil	France	Great Britain
Export of high-tech goods (% of industrial exports)	0.405	0.635	1.689	0.710	0.786	1.524	0.940	0.479	0.543
R&D expenditure,% of GDP	0.524	0.393	1.833	0.344	0.367	5.500	0.846	0.500	0.647
Networked readiness index	1.250	0.833	1.250	0.833	0.833	1.250	1.250	1.000	0.833
ICT Development Index (IDI) values	1.370	0.938	2.531	0.910	0.914	1.771	1.253	0.931	0.887
Country E-Government Development Index	1.170	0.909	1.406	0.907	0.909	1.516	1.088	0.907	0.886
Global ranking Global Cybersecurity Index (GCI)	1.010	0.903	1.163	0.950	0.985	1.077	1.449	0.911	0.898
International Digital Economy and Society Index, I-DES	1.067	0.716	-	0.706	0.750	-	1.200	0.774	0.658

Based on the data in table 3, we can conclude that Russia has comparative advantages in all respects among countries such as India and Indonesia; by such indicators as the "Networked readiness index", "ICT Development Index values", "E-government development index by country", "Global ranking Global Cybersecurity Index", "International Digital Economy and Society Index" - among China and Brazil. Also, in terms of the Networked readiness index, Russia has the same level as France.

Based on the data presented in Table 3, the calculations are performed under the following assumptions: each variable is be assigned an index in accordance with the reference values (advantage value "> 1" - score "+1", "= 1" - score "0", "<1" - score " -1 ") (table 4).

Table 4. Index of the digital economy of Russia (based on data from table 3 created by authors)

Indicators	Comparative advantages of Russia relative to this country									Average value
	China	USA	India	Japan	Germany	Indonesia	Brazil	France	Great Britain	
Export of high-tech goods (% of industrial exports)	-1	-1	+1	-1	-1	+1	-1	-1	-1	-5
R&D expenditure,% of GDP	-1	-1	+1	-1	-1	+1	-1	-1	-1	-5
Networked readiness index	+1	-1	+1	-1	-1	+1	+1	0	-1	0
ICT Development	+1	-1	+1	-1	-1	+1	+1	-1	-1	-1

Index (IDI) values										
Country E-Government Development Index	+1	-1	+1	-1	-1	+1	+1	-1	-1	-1
Global ranking Global Cybersecurity Index (GCI)	+1	-1	+1	-1	-1	+1	+1	-1	-1	-1
International Digital Economy and Society Index, I-DES	+1	-1	-	-1	-1	-	+1	-1	-1	-3
Total average						**-2.285**				

The final level of the digitalization level in Russia in accordance with the proposed calculation method is -2.285 in comparison to other countries under the investigation framework. Given the boundaries of the values that the indicator can take [from -7 to +7], the level is not high enough. Based on the findings, the main indicators that need to be further enhanced in Russia are the export of high-tech goods (in % of industrial exports); and R&D expenditures, in % of GDP. With this in mind, further development of the digital economy of Russia is possible via activation of high-tech industries and entrepreneurial activity in this area. Investments in R&D also play an important role in improving the level of digitalization of Russia.

5. Conclusion

The theoretical and practical significance and scientific novelty of this article is in the following: the authors formulate a methodological framework to measure the level of digitalization in Russia in comparison to other leading countries. The proposed framework lies the foundation for the development of relevant methodology for assessing the depth of digital economy penetration. The main features that distinguish it from the existing methods for assessing the development of the digital economy include the fact that the calculations are carried out using the Bela Ballas's formula adapted for the needs of analysis, which makes it possible to evaluate the comparative advantages of the digital economy of Russia in relation to other countries. The method was tested utilizing the relevant data set representative of the digital economy level of Russia in comparison with the indicators representative of the digital economies of China, the USA, India, Japan, Germany, Indonesia, Brazil, France, Great Britain.

References

Afonasova, M. A., Panfilova, E. E., & Galichkina, M. A. (2018). Social and Economic Background of Digital Economy: Conditions for Transition. *European Research Studies Journal, XXI* (3), 292-302.

Bakumenko, L. P., & Kostromina, E. V. (2018). Statistical analysis of the readiness of regions to participate in the digital economy [Statisticheskiy analiz gotovnosti regionov k uchastiyu v tsifrovoy ekonomike]. *Statistics in the digital economy: learning and use: proceedings of the international scientific and practical conference*, SPb.: Publishing house of St. Petersburg state economic University.

Balassa, B. (1965). Trade Liberalization and Revealed Comparative Advantage. *The Manchester School of Economic and Social Studies, 33*, 99-123.

Bucht, R., & Hicks, R. (2018). Definition, concept, and measurement of the digital economy [Opredeleniye. kontseptsiya i izmereniye tsifrovoy ekonomiki]. *Bulletin of international organizations: education, science, new economy*, 143-172.

Dyatlov, S. A. (1995). Information paradigm of social and economic development [Informatsionnaya paradigma sotsialno-ekonomicheskogo razvitiya]. *Proceedings of St. Petersburg University of Economics and Finance, 3-4*, 17-30.

Export of high-tech goods. (2019). https://knoema.com/atlas/topics/Research-and-Development/RandD-Expenditure/High-technology-exports-as-a-share-of-manufactured-exports?origin=knoema.ru

GDP, PPP, current prices (international dollars), per person, by PPP). (2019). https://knoema.com/atlas/topics/Economy/National-Accounts-Gross-Domestic-Product/GDP-based-on-PPP?origin=knoema.ru

Global Cybersecurity Index (GCI) – 2018. (2019). https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2018-PDF-E.pdf (accessed: 03.12.2019).

Kostin, K. B., & Berezovskaya, A. A. (2017). Current state and prospects of the global e-business development [Sovremennoe sostoyanie i perspektivy razvitiya mirovogo elektronnogo biznesa]. *Russian Journal of Entrepreneurship, 18*(24). https://doi.org/10.18334/rp.18.24.38563

Kostin, K. B., & Berezovskaya, A. A. (2019a). Application of neural network technologies to improve the efficiency of international tourism activities [Primeneniye neyrosetevykh tekhnologiy s tselyu povysheniya effektivnosti mezhdunarodnoy turistskoy deyatelnosti]. *Business management in the digital economy: challenges and solutions*. In I. A. Arenkov, T. A. Lezina, M. K. Tsenzharik, E. G. Chernova (Eds.). SPb.: Publishing house of St. Petersbur University.

Kostin, K. B., & Berezovskaya, A. A. (2019b). Modern technologies of digital economy as a driver of growth of the world market of goods and services [Sovremennye tekhnologii cifrovoj ekonomiki kak drajver rosta mirovogo rynka tovarov i uslug]. *Economic attitude, 9*(2), 122-129.

Measuring the Information Society Report- 2017, Volume 1. (2019). https://www.itu.int/en/ITUD/Statistics/Documents/publications/misr2017/MISR2017_Volume1.pdf

Networked readiness index. (2019). https://knoema.com/atlas/topics/World-Rankings/World-Rankings/Networked-readiness-index?origin=knoema.ru

Plaksin, S., Abdrakhmanova, G., & Kovaleva, G. (2017). Approaches to Defining and Measuring Russia's Internet Economy. *Forsythe*. https://cyberleninka.ru/article/n/approaches-to-defining-and-measuring-russia-s-internet-economy

R&D expenditure. (2019). https://knoema.com/atlas/topics/Research-and-Development/RandD-Expenditure/RandD-expenditure-as-a-share-of-GDP?origin=knoema.ru (accessed: 03.12.2019).

Schwab, K. (2016). *The Fourth industrial revolution* [Chetvertaya promyshlennaya revolyutsiya]. Eksmo, translation from English, in Russian.

Trofimov, V. V., & Trofimova, L. A. (2018). Big Data of the national statistical system in the concept of digital economy [Big Data natsionalnoy statisticheskoy sistemy v kontseptsii tsifrovoy ekonomiki]. *Statistics in the digital economy: learning and use: proceedings of the international scientific and practical conference*, SPb.: Publishing house of St. Petersburg state economic University.

United nations e-government survey – 2018. (2019). *Gearing e-government to support transformation towards sustainable and resilient societies*. https://www.unescap.org/sites/default/files/E-Government%20Survey%202018_FINAL.pdf

Zaitsev, V. E. (2019). Digital economy as an object of research: a review of publications [Tsifrovaya ekonomika kak obyekt issledovaniya: obzor publikatsiy]. *Issues of state and municipal administration*, 107-122.