Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 4, July 2021: 1621-1632

DIGITALIZATION AS FACTOR OF COMPETITIVENESS POSITION OF THE ECONOMY IN TERMS OF GLOBALIZATION

Tetiana Polozova[1], Irina Kolupaieva[2], Valeriia Prokopenko[3], Iryna Sheiko[4], Oleksandr Shabinskyi [5]

[1]Doctor of Economic sciences, Professor, Head of Economic Cybernetics and Management of Economic Security Department, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine ORCID: https://orcid.org/0000-0001-9956-8816
[2]Doctor of Economic sciences, Professor, Professor of Economic Cybernetics and Management of Economic Security Department, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine ORCID: http://orcid.org/0000-0003-1256-0817
[3]Doctor of Economic sciences, Professor, Professor of the Department Economics of Management, V.N. Karazin Kharkiv National University, Kharkiv, Ukraine
[4]PhD (Economics), Associate Professor, Associate Professor of Economic Cybernetics and Management of Economic Security Department, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine. ORCID: https://orcid.org/0000-0002-5770-3677
[5]D. Sc.Economics, Professor, Professor of Department of Producing Organization, Business and Management, Kharkiv Petro Vasylenko National Technical University of Agriculture, (Kharkiv, Ukraine), ORCID: https://orcid.org/0000-0003-4603-5025

ABSTRACT
The impact of the COVID-19 pandemic on the global economy could provide additional incentives for companies to make greater use of digital technologies. This paper aimed to examine the relationship between digital transformation on the one side and globalization performance and competitiveness of the country from another one. Analysis was performed on data of EU-members, and 8 developed countries to compare their digital activity, globalization performance and competitiveness with European level. Analysis showed that EU28 Member States compare well with 8 non-EU countries and the very best EU28 countries have digital performances at the same or higher levels than the best global countries. Multiple regression modelling proved the linkage between Globalization Index and sum of R&D funding among EU-members based on 2015-2018 data. The research found, that digitalization DESI and KOF Index provide significant impact on the value of global competitiveness score.
Keywords: globalization, digitalization, COVID-19 pandemic, global competitiveness score, multiple regression model JEL: C23, F63, O57

1. INTRODUCTION

The world has entered a new era when the impact of digital technologies is increasingly felt in all sectors of the economy. Digitalization is radically changing traditional industries and sectors. Classic business models are changing, conservative analog processes and operations are going online or losing at competition, it is possible to formulate personal proposals for each individual customer. Automation and robotics minimize the need for human resources and rapidly increase efficiency and productivity.

2. THEORETICAL FRAMEWORK

2.1 Globalization and its measurement

Globalization is a self-organizing, objective process that sooner or later covers all countries. At the present stage of development, the processes of globalization are present in the economic and social life of any country in the world. Globalization affects almost all spheres of public life. Global integration has significant benefits: the benefits of the international division of labour, the effects of scale and the rapid spread of innovation in different countries. It is also characterized by the "advantages" of foreign economic nature, such as freedom of choice due to the international movement of goods, capital and labour, freedom of thought, which is closely linked to the international movement of ideas. But the growing prosperity and integration of individual countries may even

increase political instability, as they lead to significant economic dependence on other countries, creating a sense of danger.

There are several approaches to globalization definition. Jan Scholte generalized the interpretation of globalization and singled out the five most key definitions (Scholte, 2000): 1) globalization as gradual transition to this type of relations in a society where global interests have the highest priority; 2) globalization as liberalization of trade, economic relations, communication; 3) sharing of knowledge and experience through global information systems; 4) globalization as a process of modernization of society through self-determination of the nation and the formation of national identity; 5) as a mechanism for creating a single public space that has no territorial restrictions and certainty.

The Swiss Institute of Economics (KOF), the developer of the KOF Globalization Index, defines globalization as the process of creating relationships between entities belonging to different countries and continents, expressed in a variety of flows of goods, people, information, ideas, and capital. Globalization is a process that destroys national borders, unites economies, cultures, technologies and governance, and produces complex relationships and interdependence between countries (KOF, 2020; S. Gygli, F. Haelg et al., 2019).

Baccaro (Baccaro, 2011) defines trade globalization as the share of the total volume of cross-border trade in GDP. According to Chase-Dunn (2002), trade globalization is the ratio of world export divided by all national GDPs.

There are several global rankings to measure the level of globalization, each of which is based on its own system of indicators. The most widespread and widely used indices are the index of the Swiss Economic Institute (KOF) (KOF, 2020), the Maasricht Globalization Index (L. Figge, P. Martens, 2014), new globalization index (P. Vujakovic, 2010).

The first attempt to assess the level of globalization was the rating of A.T. Kearney and Foreign Policy magazine (A.T. Kearney, 2007). According to the data of 2002-2007, it was assessed an index for 62 countries of the world, which took into account political and economic integration, personal communications, and technological advantages of countries. Evaluation used reference values with which national indicators were compared.

The Maasricht Globalization Index (MGI) (L. Figge, P. Martens, 2014) is based on the calculation of 11 indicators that characterize the level of political, economic, social / cultural, technological, environmental globalization. However, the rating was compiled only for three years – 2000, 2008, 2012.

Nowadays the most common and more cited is the KOF index, which covers the period 1970 to 2018, with a calculation of 42 parameters for 209 countries (2020 revision). KOF index is quantitative measurement of the degree of development of globalization processes, which covers economic, social and political aspects of globalization. It was developed in 2002 by the Swiss Institute for Business Research and today has become one of the most authoritative in the world (KOF, 2020; S. Gygli, F. Haelg et al., 2019). Economic globalization reflects the flows of goods, services, capital and information that accompany such exchanges. In economic globalization, there are separate trade and financial components. Social globalization (informational, cultural and interpersonal components) contains the spread of thoughts, information, ideas, and impressions. Political globalization is characterized by the spread of government policy to other countries, the creation of supranational authorities.

In addition to the division into economic, social and political components, there is also a division into action indicators (de facto) and policy indicators (de jure). Thus, actions characterize the intensity of actual flows, symbolizing globalization (exports / imports, international investment, migration and tourism, information exchange), then policy indicators assess the performance of instruments and mechanisms of globalization: legislation, taxation of export / import income, trade restrictions, etc. The structure of the globalization index KOF by individual components is shown in table 1 (last 2020 revision).

Table 1 – Structure of the KOF Globalisation Index

Globalisation Index, de facto	Weights	Globalisation Index, de jure	Weights
1	2	3	4
Economic Globalisation, de facto	33.3	**Economic Globalisation, de jure**	33.3
Trade Globalisation, de facto	50.0	*Trade Globalisation, de jure*	50.0
Trade in goods	37.1	Trade regulations	26.2
Trade in services	43.4	Trade taxes	27.9
Trade partner diversity	19.5	Tariffs	27.5
Financial Globalisation, de facto	50.0	*Financial Globalisation, de jure*	50.0
Foreign direct investment	26.4	Investment restrictions	30.6
Portfolio investment	16.8		
International debt	28.1	Capital account openness	39.0
International reserves	1.3		
International income payments	27.3	International Investment Agreements	30.4

Social Globalisation, de facto	33.3	**Social Globalisation, de jure**	33.3
Interpersonal Globalisation, de facto	33.3	*Interpersonal Globalisation, de jure*	33.3
International voice traffic	20.5	Telephone subscriptions	39.4
Transfers	22.0	Freedom to visit	32.3
International tourism	21.5	International airports	28.4
International students	18.9		
Migration	17.1		
Informational Globalisation, de facto	33.3	*Informational Globalisation, de jure*	33.3
Used internet bandwidth	41.4	Television access	37.5
International patents	29.2	Internet access	42.6
High technology exports	29.4	Press freedom	19.9
Cultural Globalisation, de facto	33.3	*Cultural Globalisation, de jure*	33.3
Trade in cultural goods	28.6	Gender parity	23.1
Trade in personal services	24.7	Human capital	41.6
International trademarks	8.2	Civil liberties	35.2
McDonald's restaurant	21.9		
IKEA stores	16.5		
Political Globalisation, de facto	*33,3*	**Political Globalisation, de jure**	*33,3*
Embassies	37.1	International organisations	36.5
UN peace keeping missions	24.7	International treaties	32.6
International NGOs	38.2	Treaty partner diversity	30.9

Source: KOF (2020)

The de jure and de facto indicators are calculated separately. The KOF Globalization Index has been calculated annually since 1970. The latest revision was made at 2020 on the base of 2018 data from international organizations such as the World Bank, the International Monetary Fund, UNESCO, and a number of others. But, for some countries it is not possible to obtain initial data, and therefore the method of linear interpolation is used to bridge the gaps in the dates. Table 1, in addition to the structure of the components of the globalization index, also shows the weights of individual parameters. The weights of individual parameters may vary, but the weights of sub-indices and individual components remain unchanged – the weights of all three components in the overall index are the same KOF (2020).

A lot of authors discuss potential risks of further globalization.

M. Raab, M. Ruland, et al. (2008) describe such negative results of open global space: rising tax competition among welfare states, intensification of innovation can lead to economic and social transformations, increasing volatility of markets and uncertainty. T. Polozova (2016) proposes methodical approach to calculation of opportunities innovative and investment development of the enterprise, including risk measurement. J. Arpe, H. Glockner and H. Hauschild in their investigation (J. Arpe et al., 2012) summarize expert opinion about potential risks of globalization and form 11 risk areas: food and water scarcity, energy and resource scarcity, socioeconomic inequality, uncontrolled mass migration, international terrorism, aging societies, sovereign debt/default, financial market collapse, protectionism and trade wars, pandemic outbreaks, technology infrastructure failure.

In a paper (V. Prokopenko et al., 2020) authors made an accent on security risks for financial traders in the conditions of globalization. They proposed the methodological approach to define the level of financial security of players at global financial market.

The pandemic has only strengthened existing opinions about the negative consequences of globalization.

2.2 Negative results of COVID-19 on international business and trade

The COVID-19 pandemic has negatively affected the economies of all countries. The economic crisis has become global. As a result, the world has received significant unemployment and poverty rates, which vary depending on the country and sector. Governments of all countries and international organizations have focused their efforts on developing a recovery strategy. As practice shows, the transition from recession to growth can be ensured through a successful government policy, which provides for an extremely strict quarantine regime, as well as measures of production stimulation. The International Monetary Fund's forecasts for the World Banking Group indicate economic growth in 2021 by 5.5% and in 2022 by 4.5%. The recovery trend varies from country to country, due to access to the vaccine, as well as effective regulatory policy (table 1, table 2).

Authors (W. McKibbin and R. Fernando, 2020) explores seven different scenarios of how COVID-19 might realized globally. They used modelling methods to convert different assumptions about mortality rates and morbidity rates in the country where the disease outbreak occurs (the epicentre country). Also authors created a set of filters that convert the pandemic shocks into economic shocks: reduced labour supply in each country (mortality and morbidity); rising cost of doing business in each sector including disruption of production

networks in each country; consumption reduction due to shifts in consumer preferences; rise in equity risk premium on companies in each sector and in each country (based on exposure to the disease); and increases in country risk premium based on exposure to the disease as well as vulnerabilities to changing macroeconomic conditions.

Also authors pointed out the importance of global cooperation "...The idea that any country can be an island in an integrated global economy is proven wrong by the latest outbreak of COVID-19. Global cooperation, especially in the sphere of public health and economic development, is essential. All major countries need to participate actively..." (W. McKibbin and R. Fernando, 2020).

International agencies have made their forecast about trends in post-pandemic world. World Bank in its forecast suggested, that adoption and globalization of digital services that were introduced during the pandemic, could leads to global productivity growth (World Bank, 2021). Also the forecast of main macroeconomic indicators for regions all over the world was created (table 2, table 3).

Table 2 – Volume of output and trade (Percent change)

Index	2021	2022
World output	5.5	4.2
Advanced Economies output	4.3	3.1
Emerging Market and Developing Economies output	6.3	5.0
World Trade volume	8.1	6.3
Advanced Economies trade	7.5	6.1
Emerging Market and Developing Economies trade	9.2	6.7

Source: World Economic Outlook

Table 3 – Real GDP growth at market prices in percent, unless indicated otherwise

Region	2021		2022	
	GDP	GDP per capita	GDP	GDP per capita
East Asia and Pacific GDP	7.4	6.8	5.2	4.7
Europe and Central Asia	3.3	3.1	3.9	3.7
Latin America and the Caribbean	3.7	2.8	2.8	2.0
Middle East and North Africa	2.1	0.5	3.1	1.6
South Asia forecast	3.3	2.1	3.8	2.7
Sub-Saharan Africa	2.7	0.1	3.3	0.7

Source: World Bank Group forecast

So, World Bank on the basis of its own calculations is rather optimistic in its predictions about world output and international trade. It is worth to mention, that perspectives of Emerging Markets and Developing Economies seems to be better, that for developed countries.

2.3 Globalization in post-pandemic era

An active discussion exists among scientists about future trends of globalization in post-pandemic era. Some authors are at positions of protectionism, nationalism and relative "isolation" of national economies, another authors believe that globalization will restore its positions in future (F.J. Contractor, 2020; W. McKibbin and R. Fernando, 2020). It is also feared that negative consequences of globalization may lead to a political backlash against it, and even to its undoing (Berger, 2000; OECD, 2007; Scheve and Slaughter, 2007; Scheve and Slaughter, 2004; V. Prokopenko et al., 2020), and might bring back some form of economic protectionism.

F. J. Contractor (2020) proposes reasons why the future world economy will need even more globalization. Instead tendencies to protectionism and nationalism, he also protects multinational business due to combining demand from several markets, greater technological capacity and R&D budgets at MNEs, specialization and global value chains (GVC). Instead of the dire predictions of a post-pandemic world characterized by increased global risks, decoupling of economies, shake-up of global value chains, and the retreat of globalization, this article proposes that the changes induced by heightened nationalism and protectionism will be marginal rather than fundamental in nature. These marginally higher risks can easily be handled and ameliorated by multinational enterprises through alternate cross-border business strategies and emerging technologies.

The crisis caused by the COVID-19 pandemic has become a significant catalyst for the spread of digital technology around the world. The digital format of doing business has solved a significant number of problems facing business, education and government in the economic and social spheres. It is digitization that will make it possible to reduce economic losses and turn business into a remote mode. In our opinion, an important aspect of overcoming the crisis should be not only vaccination and regulatory policy, but also the digitalization of society. The availability of digital services makes it possible to reduce the impact of limited mobility and speed up

access to state aid and other financial services, as well as to facilitate job search and increase employment. On the part of the state, this requires investment in digital infrastructure, as well as the development of a digital strategy to ensure security and promote competitiveness. The paper (Gavkalova, Kolupaieva, Barka Zine, 2017**)** presents an approach to analysing the efficiency and cumulative impact of state regulatory policy levers, which creates conditions for the environment in which the state must take measures in order to ensure effective implementation of its regulatory policy.

V. Kyriy et al. (2019) proved an importance of information support and digital innovations for organizational transformations at an enterprise: such transformations became very actual now due to remote work and social distance requirements.

2.4 Role of digital innovations in post-pandemic recovery

The impact of the COVID-19 pandemic on the global economy could provide additional incentives for companies to make greater use of digital technologies.

The decline in demand associated with the pandemic may combat the shift to e-commerce, at least in some segments. Digital solutions can also counteract the absence of health-related workers to alleviate the supply crisis. Remote work will be actively used in this context.

Another response to the Covid-19 pandemic experience in the medium term is to increase the use of machines, robots and other digital technologies in production processes. By replacing human labour, automation reduces dependence on it.

This trend is already in full swing, as digital technologies significantly increase productivity and reduce costs. The use of such technologies to increase resilience to crises affecting production is an additional incentive. However, not all industries and companies have the same opportunities to use digital technology to reduce their vulnerability to crises.

Various aspects of digital innovations and its social and economic impact have been studied and discussed by a great number of theorists and practitioners of international economics and business. Problems of assessing the impact of digitalization on economic development are widely covered in the economic press and academic societies.

Bart Van Ark et al. (2003) analyzed European IT market in the 90s of XX century and found out that European economies lost their competitive positions from Canada or United States due to regulations that make limitations to a quick proliferation of the digital economy infrastructure in the sectors that were the users of ICT. Also authors analyzed industries that produce ICT products and services, those that invest strongly in ICT, and those that make less intensive use of ICT. The main findings are that the inverse relationship between employment and productivity growth has been much more prominent in manufacturing industries than in services industries.

Oliner and Sichel studied correlation between IT sector development and output growth – how much could computers contributed to economic growth over 1980s. Authors explains the low contribution of computers in output by the facts that much of the gross return to computers was eaten up by depreciation and also because computing equipment was a very minor share of the total capital stock (data of 80-90s of XX).

Sona Mardikyan, Endam Aycicek Yıldız, Mehmet Derya Ordu and Burcu Şimşek (2015) investigated digital and IT gaps between groups of countries: they analyzed ICT accessing and using at global level. Authors found, that there is a significant difference between developed and developing countries and between OECD member and not member countries.

To assess the level of digitization of European countries Digital Economy and Society Index (DESI) is used. The Digital Economy and Society Index (DESI) is an integrated index that estimates digital competitiveness of the EU countries and comprises of such dimensions: connectivity, human capital, use of internet services, integration of digital technology, digital public services (DESI, 2020). Each dimensions made up of sub-dimensions. Connectivity characterises access to a fast and reliable broadband connection (fixed and mobile connections). Human capital includes Internet user skills and advanced skills analysis. Use of internet services is investigated with sub-dimensions - citizens' use of internet services and online transactions investigation. Integration of digital technologies includes business digitisation and e-commerce. The weight of each dimensions are different the highest level 25% has connectivity and human capital, integration of digital technology has 20%, and others has 15% (DESI, 2020).

The International DESI Index (I-DESI) mirrors and extends the EU28 Digital Economy and Society Index (DESI) by utilizing 24 datasets to compare digital performance of EU members and global developed countries – I-DESI is calculated for 45 countries.

Having such powerful tool, as digital ranking, we can explore how digital progress can effect on global performance of the country that is measured by globalization index.

Also, it is very important to check the relation between digitalization progress and success in globalization indexes. Nowadays scientists pay a lot of attention to the problem of measurement of economic consequences of COVID-19 especially in the field of international trading, global value chains (GVC), required time to return to the "new normal" state. Although the future is uncertain and no one has a clear idea of what the "new normal" state looks like, there is a high probability that many companies will look for an acceptable format of work,

combining remote form, online meetings, office meetings in certain time, change of modes of stay in offices, robotics and automation of technological operations.

C.L. Mann (2020) suggests that manufacturing spillovers from factory closures loom large in the near term, but production will rebound to restock inventories once quarantines end and factories reopen, but the duration of closure is uncertain.

S. Shkarlet et al. (2020) pointed out, that in global world the problem of transforming managerial decisions process in government management, using digital technology support, appears to be key element to the integration of national economies into global processes.

R. Baldwin and E. Tomiura (2020) said, that pandemic cause shock on demand and supply side of international trading. Authors explained three most negative results of pandemic on global manufacturing: direct supply disruptions, supply-chain contagion and demand disruptions. Also supply and demand shock effects on aggregate trade flow. Also authors predict risk of permanent damage to the global trade system driven by policy and firms' reactions.

Due to uncertain perspectives of post-pandemic recovery it is important to investigate the digitalization progress as a main tool to support transition of international business, manufacturing and global value chains to the new normal state.

The aim of the article is to investigate the relationship between digitalization and globalization processes for EU and to analyze the impact of digital progress of country on its global competitiveness score, comparing EU-members with developed countries.

3. METHODOLOGY

Statistical data for model building we took for EU-28 countries from 2015 to 2018 years.

Analysis of theoretical studies allows us to concentrate of such groups of indexes to collect data:

1. DESI 2019 Index.
2. DESI International Index 2018 with Global Competitiveness Ranking Score (World Economic Forum, 2018). To compare digital performance of EU-members we add data of eight high developed countries: USA, China, Korea Rep., Japan, Australia, Canada, Norway and Brazil, that represent different regions.
3. KOF globalization Index (KOF, 2020), based on revised data of 2018 (KOF, 2020).
4. Global Competitiveness Index (WEF, 2018).
5. Data of financing of R&D: Intramural R&D expenditure (GERD) for all sectors of performance, Euro per inhabitant, Business sector expenditures on R&D, Euro per inhabitant of EU-members for 2015-2018 (Eurostat, 2020).
6. Total high-tech trade, % in total turnover. Descriptive statistics of variables is shown at table 4 – all this data we should use in our multiple regression models.

Table 4 – Description of variables and descriptive statistics

	Name	Description	Valid cases	Mean	Min	Max	STD
Relation between DESI, R&D financing, high-tech trade and KOF level among EU-members	DESI	Digital Economy and Society Index	116	4354.194	2613.287	6396.630	908.0459
	KOF	KOF Globalization Index	116	84.034	74.518	91.313	4.1771
	KOF_EC	KOF Economic Globalization	116	80.534	68.773	89.667	5.4907
	GERDln	Intramural R&D expenditure (GERD) for all sectors of performance, Euro per inhabitant	116	5.252	2.617	7.049	1.2245
	BERDln	Business sector expenditures on R&D, Euro per inhabitant	116	5.818	3.674	7.387	1.0540
	HTEC_TRN	Total high-tech trade, % in total turnover	112	11.461	6.200	33.100	4.0668
Relation between KOF and DESI (with components)	DESI_I	International Digital Economy and Society International Index (DESI_I)	37	51.19	35.0	71.0	10.69
	CON	Dimension of Connectivity of DESI_I	37	62.06	46.0	74.0	6.15
	SKILLS	Dimension of Human	37	42.81	24.0	66.0	11.16

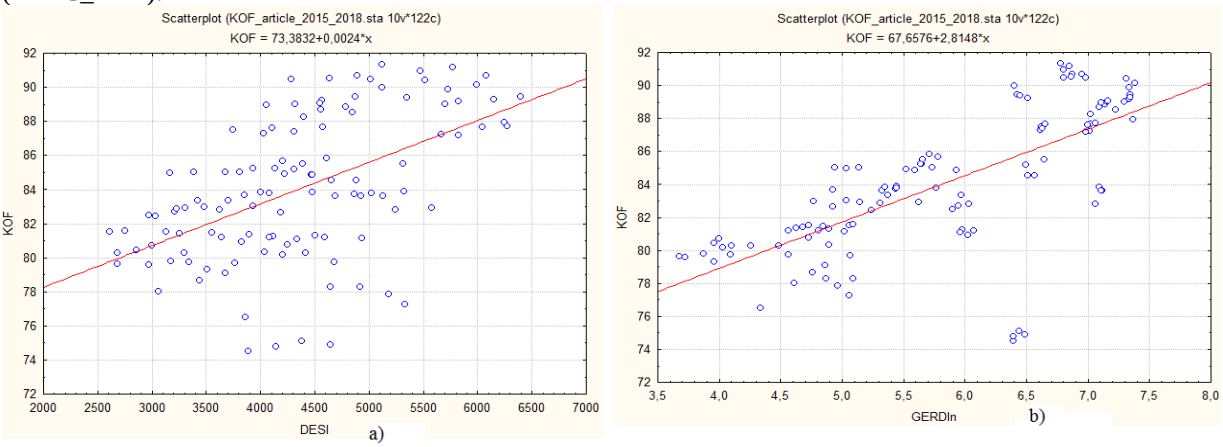
		Capital of DESI_I					
	USE	Dimension of Use of Internet Service of DESI_I	37	49.58	27.0	74.0	11.91
	IDT	Dimension of Integration of Digital technology of DESI_I	37	42.83	10.0	83.0	20.89
	PUB	Dimension of Digital Public Service of DESI_I	37	59.61	26.0	86.0	15.29
	COMP	Global Competitiveness rating score	37	73.11	59.5	85.6	7.33
	KOF	KOF Globalization Index	37	82.54459	64.28000	90.68000	5.860491

Source: constructed by authors

Analysis of data has shown, that the minimum and maximum values are significantly different from average and standard deviation for such variable as Intramural R&D expenditure (GERD) for all sectors of performance and Business sector expenditures on R&D (BERD), so we covert values as logarithms. The same approach are used by Heidy Ali (Heidy Ali, 2020), Park (Park, 2019).

To provide statistical analysis and model building STATISTICA software was used.

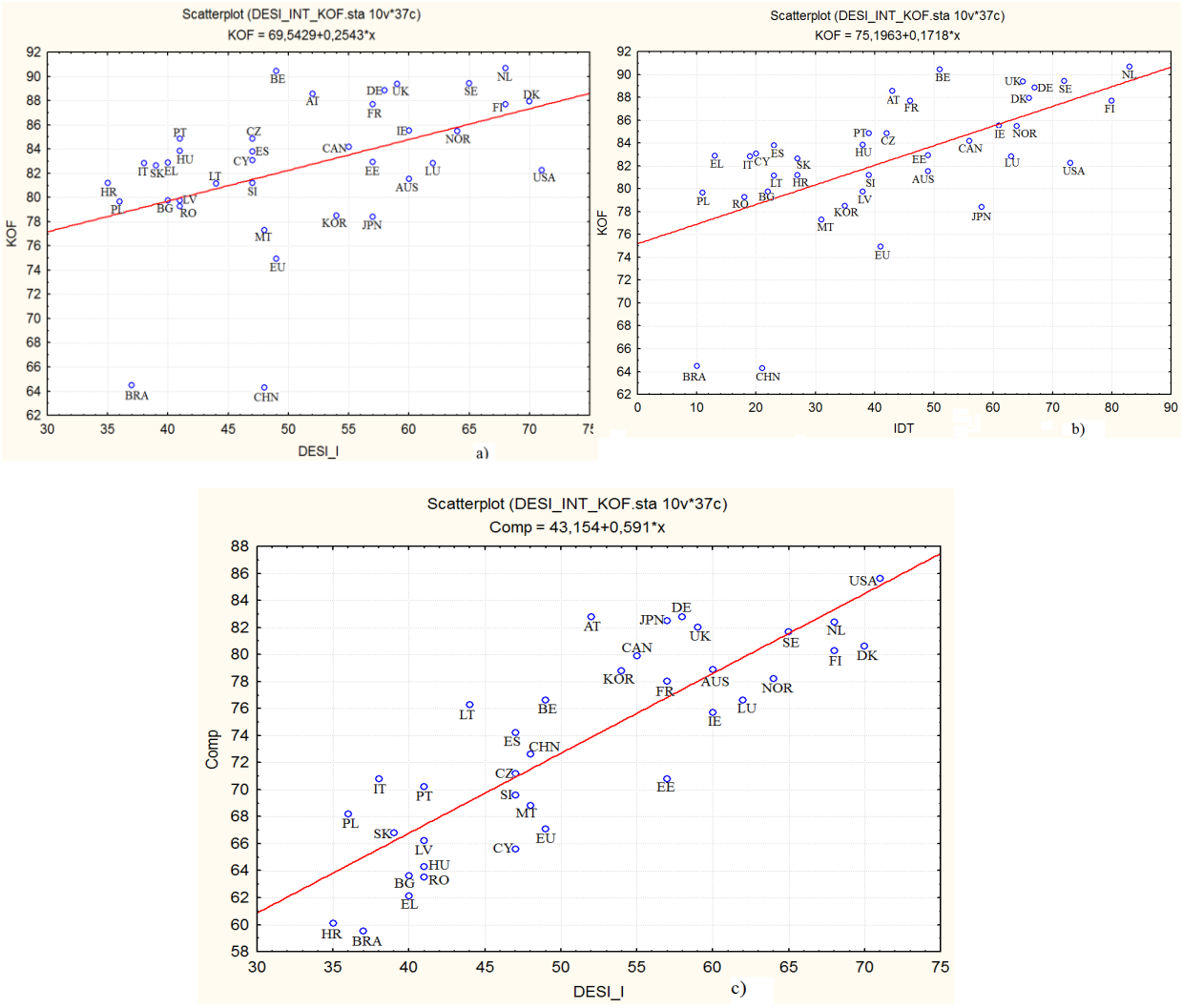
A preliminary analysis of EU-members data for 2015-2018 showed a strong relationship between globalization index and the DESI index. The correlation coefficient between the KOF and DESI index is 0.57 (Figure 1 a), which is confirmed by a significant variation in data around the main trend. Thus, in order to correctly describe the relationship between KOF and DESI, additional factors are needed. One of them is Intramural R&D expenditure (GERD) for all sectors of performance (Figure 1b), the correlation coefficient of which with the globalization index KOF is 0.84. Also, a candidate for inclusion in the regression model is Total high-tech trade (HTEC_TRN).



Source: constructed by authors

Figure 1 – Relationship between KOF index and DESI (a), GERD (b)

Analysis of data for the EU countries and eight economically developed countries gives grounds for drawing preliminary conclusions about the presence of a relationship: between the globalization coefficient and the international DESI index (Figure 2 a), between the KOF coefficient and the DESI sub-index characterizing the union (Figure 2b); between the global level of competitiveness and the DESI index (Figure 2c).



Source: constructed by authors

Abbreviation used: EU-European Union, AU -Austria, BE- Belgium, BG- Bulgaria, HR – Croatia, CY – Republic of Cyprus, CZ - Czech Republic, DK - Denmark, EE-Estonia, FI-Finland, FR-France, DE-Germany, EL - Greece, HU-Hungary, IE-Ireland, IT-Italy, LV-Latvia, LT-Lithuania, LU-Luxembourg, MT-Malta, NL-Netherlands, PL-Poland, PT-Portugal, RO-Romania, SK-Slovakia, SI-Slovenia, ES-Spain, SE-Sweden, UK-United Kingdom; Non-EU: AUS -Australia, BRA-Brazil, CAN-Canada, CHN-China, JPN-Japan, KOR-Korea, NOR-Norway, USA

Figure 2 – Relations between KOF, DESI International Index and Global Competitiveness Index

Analysis showed that EU28 Member States compare well with 8 non-EU countries and the very best EU28 countries have digital performances at the same or higher levels than the best global countries. Indeed Denmark was the leading country in the I-DESI index. EU28 Member States perform best, relative to the 8 non-EU countries

All these relationships should be investigated in detail when building a regression model.

4. RESULTS AND DISCUSSION

Our investigation, presented in this section aims at assessing how digitalization indexes (in our case – Digital Economy and Society Index (DESI) and International DESI (I-DESI) with its dimensions) affect countries' globalization performance. Also we would try to check, how progress in DESI Index with KOF Globalization Index for EU-members can improve their positions in Global Competitiveness Score.

Data for model building are obtained from Eurostat (Eurostat, 2020), KOF Institute (KOF, 2020) and World Economic Forum annual report (WEF, 2018), where Global Competitiveness score is published and cover 28 EU countries over the period 2015-2018 and 8 global developed countries, that represent different regions.

The general purpose of multiple regression model (the term was first used by Pearson, 1908) is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. Due to the short time span of the data-set our estimates are based on a repeated cross-section (pooled estimates) using Generalised Least Squares with heteroschedastic robust standard errors. The goal of linear regression

procedures is to creates such line (trend at figures 1 and 2) to cover maximum quantity of points at scatterplot. Specifically, *STATISTICA* computes a line so that the squared deviations of the observed points from that line are minimized. Thus, this general procedure is sometimes also referred to as least squares estimation.

Due to analysis of theoretical framework it is useful for our investigation to explore the impact of digitalization indexes, parameters of science and research sector on two independent variables: KOF Globalization index - to build the model for EU-members, and Global Competitiveness Score for EU countries and 8 developed countries. All graphs and multiple regression model were built in STATISTICA software.

Analysis of such linkages, represented on figures 1-2, demonstrates a number of facts that we can use in our study: existence of linkage between KOF and DESI for EU-members, correlation between KOF and GERD, impact of I-DESI with KOF on Global Competitiveness Score.

At first we study European Digital performance on the base of DESI for 2015-2018 and find the multiple regression model for KOF Globalization index:

$$KOF = 70.39 + 2.6 \cdot GERD\ln + 0.035 \cdot HTEC\_TRN + \mathrm{Re}sidual . \quad (1)$$

It is important to note that DESI provide small impact on KOF value due to received results. So, our preliminary conclusion about linkage of Digitalization Index and KOF is not proved by our regression results.

The fact, that DESI and KOF correlation is not very high allow us to use both of them to study their impact on Global Competitiveness Score (the difference is that in second model we used International DESI (DESI_I independent variable) instead standard DESI. Due to modelling of multiple regression on the base of EU-members and 8 global competitors (USA, China, Korea Rep., Japan, Australia, Canada, Norway and Brazil) on the newest available data (KOF Globalization Index, revised in 2020, is based on 2018 data) such equation was received:

$$COMP = 28.34 + 0.213 \cdot KOF + 0.537 \cdot DESI\_I . \quad (2)$$

Table 5 presents the results of both models. Only significant factors were included in the table. The multiple correlation coefficients of two models are greater than 0.8 that prove the significant quality of results. Adjusted coefficient of determination (R-square) is about 0.70 for two models: we include significant factors, that allows to explain the most part of variability of dependent variables, the rest 30% of variety is explained by residuals.

Table 5 – Results of multiple regression models

Independent variables	B-coefficient	p-level	Correlation between dependent and independent variable
Dependent variable: KOF Number of cases: 112; Multiple correlation R = 0.84; R^2 = 0.71 Adjusted R^2 = 0.704 Standard error of estimate: 2.102			
Intercept	B= 70.39	0.00	
GERDln	2.6	0.00	0.84
HTEC_TRN	0.035	0.49	0.49
Dependent variable**:** Comp Number of cases: 37; Multiple correlation R = 0.8548; R^2 = 0.731 Adjusted R^2 = 0.714 Standard error of estimate: 3.95			
Intercept	B=28.34	0,004	
KOF	0.213	0.101	0.52
DESI_I	0.536	0.000	0.84

Source: calculated by authors

As about redundancy and residual analysis, tolerance, R-square is given at table 6. The tolerance of a variable in is defined in Statistica software as 1 minus the squared multiple correlation of this variable with all other independent variables in the regression equation. Therefore, the smaller the tolerance of a variable, the more redundant is its contribution to the regression (i.e., it is redundant with the contribution of other independent variables). The R-square value is an indicator of how well the model fits the data and partial correlation indicate the linkage between the respective variable and the dependent variable, after controlling for all other independent variables in the equation.

Table 6 – R-square, Partial correlation between dependent variables and factors of each multiple regression model

Independent variables	Tolerance	R-square	Partial Correlation
Independent variable: KOF			
GERD	0.9356	0.064	0.80
HTEC_TRN	0.9356	0.064	0.035
Independent variable**: Comp**			
KOF	0.7906	0.209	0.277
DESI_I	0.7906	0.209	0.277

Source: calculated by authors

On the basis of received regression results we can make several conclusions.

At first, multiple regression modelling proved the linkage between Globalization Index and sum of R&D funding among EU-members based on 2015-2018 data. The small significance of DESI impact on KOF level can be explained by difference in scales of coefficients – to calculate impact of DESI we should multiply great DESI value to small coefficient to receive KOF values less than 100.

But on the base of second multiple regression model we found, that together International DESI and KOF Index provide significant impact on the value of global competitiveness score.

The linkages between the factors of our model (independent variables) and dependent variables is proved by high levels of tolerance index, R-square and partial correlation.

5. CONCLUSIONS

This paper aimed to examine the relationship between digital transformation on one side and globalization performance and competitiveness of the country at another. Due to multiple regression model the relations of several groups of factors (including digitalization index, parameters of R&D sector, production of high-tech sector) their impact on KOF Globalization Index was studied.

Multiple regression modelling proved the linkage between Globalization Index and sum of R&D funding among EU-members based on 2015-2018 data. The small significance of DESI impact on KOF level can be explained by difference in their scales. But together International DESI and KOF Index provide significant impact on the value of global competitiveness score, due to second multiple regression model.

The multiple correlation coefficients of two models are greater than 0.84 that prove the significant quality of results. Adjusted coefficient of determination (R-square) is about 0,70 for two models: we include significant factors, that allows to explain the most part of variability of dependent variables, the rest 30% of variety is explained by residuals. The further investigations need to find additional factors to increase the quality of regression results. Also additional studies are need to measure the impact of digital technologies on post-pandemic recovery to international business, international trade and transforming of global value chains into some "new normal" form.

In a changing environment, those who best adapt to new conditions win. This is especially true of the leading sectors of the IT sector, which must meet the needs of business in the organization of online and remote work, and society in the organization of interpersonal communications, education and entertainment.

Perhaps the greatest understanding of the Covid-19 crisis is that change is happening faster than expected. Every country or person that adapts more quickly to these changes has a competitive advantage. Therefore, policies that improve adaptability and acceptance of change are even more important than before. Countries that are stuck depending on the path and adapt too slowly will not become the best in the world after a pandemic.

REFERENCES

- Andersen, T. and Herbertsson, T. (2013). Measuring Globalization. *Institute for the Study of Labor Discussion Paper*. July, № 1214, 8-10.
- Arpe, J., Glockner, H., Hauschild, H., Petersen, T., Schaich, A. and Volkmann, T. (2012). *The Economic Risks of Globalization: Expert and Public Opinion Survey Results. Global Choices* 1/2012.
- Antràs, Pol, Stephen Redding, and Esteban Rossi-Hansberg. Working Paper. "Globalization and Pandemics".
- Ark Van, B., Inklaar, R., McGuckin, R. H., and Timmer, M. P. (2003). The Employment Effects of the "New Economy" A Comparison of the European Union and the United States. *Economics Program Working Paper Series*. University of Groningen and The Conference Board, March 2003, EPWP #03–02.
- Baccaro, L. (2011). Labor, globalization and inequality: are trade unions still redistributive? in Brady, David (ed.). Comparing European Workers Part B: Policies and Institutions. Emerald Group Publishing Limited.
- Berger, S. (2000). Globalization and politics. *Annual Review of Political Science*, 3, 43–62.

- Baldwin, R. and Tomiura, E. (2020). Thinking ahead about the trade impact of COVID-19 in "Economics in the Time of COVID-19" edited by Richard Baldwin and Beatrice Weder di Mauro, CEPR Press.
- Chase-Dunn, C. (2002). Globalization: A World-Systems Perspective, in Preyer, G., M. Bös. Borderlines in a Globalized World: New Perspectives in a Sociology of the World-System. Kluwer Academic Publishers.
- Digital transformation Monitor (2017). Key lessons from national industry 4.0 policy initiatives in Europe May. URL: https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Policy%20initiative%20comparison%20v1.pdf.
- Eurostat database URL: https://ec.europa.eu/eurostat/web/main/data/database.
- Frankel, J. (2013). The Environment and Globalization. Cambridge: MA. URL: http://dx.doi.org/10.33886/w10095.
- Figge, L. and Martens, P. (2014). Globalisation Continues: The Maastricht Globalisation Index Revisited and Updated. # 11. Globalizations. URL: http://pimmartens.info/wp)content/uploads/2013/05/Figge)and)Martens_2014_Globalisation)continues.pdf
- Gygli, Savina, Florian Haelg, Niklas Potrafke and Jan-Egbert Sturm (2019). The KOF Globalisation Index – Revisited, *Review of International Organizations*, 14(3), 543-574. URL: https://doi.org/10.1007/s11558-019-09344-2.
- Dunford, M. and Bing, Qi (2020). Global reset: COVID-19, systemic rivalry and the global order, *Research in Globalization*, Volume 2, 2020, 100021, ISSN 2590-051X. URL: https://doi.org/10.1016/j.resglo.2020.100021.
- IMF (2000). The potential and the dangers of globalization. IMF Issues Brief on 12.04.2000, URL: http://www.imf.org/ external/np/exr/ib/2000/rus/041200r.htm.
- International Digital Economy and Society Index https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi.
- Heidi Aly (2020). Digital transformation, development and productivity in developing countries: is artificial intelligence a curse or a blessing? *Review of Economics and Political Science*. URL: DOI 10.1108/REPS-11-2019-0145.
- Hyun Jee Park and Sang Ok Choi (2019). Digital Innovation Adoption and Its Economic Impact Focused on Path Analysis at National Level. *J. Open Innov. Technol. Mark. Complex.* 5, 56.
- Kearney, A.T. and Foreign Policy (2007). Globalization Index. Washington, D.C.: Carnegie Endowment for International Peace.
- Kyriy, V., Sheiko, I. and Petrova, R. (2019). Optimization of management information support as a basis for organizational transformations at an enterprise. *Periodicals of Engineering and Natural Sciences*, *7*(2), 679–689. URL: https://doi.org/10.21533/pen.v7i2.564.
- KOF Globalisation Index: Variables description. (2020). URL: https://ethz.ch/content/dam/ethz/special-interest/dual/kof-dam/documents/Medienmitteilungen/Globalisierungsindex/KOFGI_2020_variables.pdf.
- Kolupaieva, I. V., Gavkalova, N. L. and Barka, Zine (2017). Analysis of leverages' efficiency in the context of state regulatory policy implementation. *Economic Annals-XXI.* Volume 165, Issue 5-6, 41-46. URL: https://doi.org/10.21003/ea.V165-09.
- Mann, C.L. (2020). Real and financial lenses to assess the economic consequences of COVID-19 81 in "Economics in the Time of COVID-19" edited by Richard Baldwin and Beatrice Weder di Mauro CEPR Press.
- Mardikyan, S., Yıldız, E.A., Ordu, M.D. and Şimşek, B. (2015). Examining the Global Digital Divide: A Cross-Country Analysis. *Communications of the IBIMA.* DOI: 10.5171/2015.592253.
- McKibbin, W and R Fernando (2020). The Global Macroeconomic Impacts of COVID-19: Seven Scenarios, CAMA Working paper, The Australian National University.
- OECD employment outlook (2007). Paris: OECD.
- Oliner, S.D.; Sichel, D.E. (1994). Computers and output growth revisited: How big is the puzzle? Brook. Pap. Econ. Act., 25, 273–334.
- Polozova, T. V. (2016). Methodical support for estimation of innovative and investment development potential at enterprises. *Actual Problems of Economics*, *178*(4), 440–450.
- Prokopenko, V., Ponomorova, M., Kornieva, N. And Babych, D. (2020) Finansial Security of players in the finansial markets in the conditions of globalization and strategic development. *PalArch's Journal of Archeology of Egypt / Egyptology*, 17(6), 7230-7247.
- Raab, M., Ruland, M., Schonberger, B., Blossfeld, H.-P., Hofacker, D., Buchholz, S., and Schmelzer, P. (2008). GlobalIndex: A sociological approach to globalization measurement. *International Sociology*, 23, 596–631. doi:10.1177/0268580908090729.
- Recovery plan for Europe (2020). URL: https://ec.europa.eu/info/strategy/recovery-plan-europe_en.

- Scheve, K., and Slaughter, M. J. (2004). Economic insecurity and the globalization of production. *American Journal of Political Science*, 48, 662–674.
- Scheve, K. F., and Slaughter, M. J. (2007). A new deal for globalization. *Foreign Affairs*, 86, 34–47.
- Scholte, J. A. Globalization (2000). A critical introduction. London: Palgrave, 2000. 361 p.
- Shangquan, Gao (2000). Economic Globalization: Trends, Risks and Risk Prevention, CDP Background Papers, United Nations, Department of Economics and Social Affairs. URL: https://EconPapers.repec.org/RePEc:une:cpaper:001.
- Shkarlet, S.M., Tkachuk, V.A., Prokopenko, V.Yu. (2020). Methodology Of Managerial Innovations In Governmental Management. *International Journal of Advanced Science and Technology*, *29*(8s), p. 2538-2543.
- Surugiu, M-R. and Surugiu, C. (2015). International Trade, Globalization and Economic Interdependence between European Countries: Implications for Businesses and Marketing Framework, Procedia Economics and Finance, Volume 32, Pages 131-138. URL: https://doi.org/10.1016/S2212-5671(15)01374-X.
- Vujakovic, P. (2010). How to measure globalisation? A new globalisation index, FIW Working Paper, 46. URL: http://www.fiw.ac.at/fileadmin/.
- World Bank. (2021). *Global Economic Prospects, January 2021*. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1612-3.
- World Economic Forum The Global Competitiveness Report (2018). URL: https://www.weforum.org/reports/the-global-competitveness-report-2018.