



Economia Aziendale Online

Economia Aziendale Online

Business and Management Sciences
International Quarterly Review

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Pavia, March 31, 2023
Volume 14 - N. 1/2023

DOI: 10.13132/2038-5498/14.1.51-66

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Transformation to Digital Economy: Source for inequality or Tool of Advancement?

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Cite as:

Sepashvili, E. (2023). Transformation to Digital Economy: Source for inequality or Tool of Advancement? *Economia Aziendale Online*, 14(1), 51-66.

Section: *Refereed Paper*

ABSTRACT

Transformation towards the digital world is the key modern direction of global economic development. Our society is going through a qualitatively new stage of evolution. This stage is characterized by the greatest influence of technologies. The common nature of these technologies is digitization, which is changing our daily lives. These processes have become even more noticeable and important under the conditions of the Covid-19 pandemic. Pandemic-related restrictions have made governments, businesses, and individuals acutely aware of the need and urgency to implement digital technologies into everyday life as quickly as possible. As a result, the process of digitalization of the world has accelerated unprecedentedly. The article stress of differences between the developed and developing world in terms of the speed of digitalization and the level of utilization of new technologies. Developed economies with abandoned knowledge, a better-trained workforce with digital skills and greater access to appropriate infrastructure utilize and exploit modern technologies' wider range of opportunities, than developing countries, which are characterized not only by low income but as well by less expenditure on Research and Development, education and infrastructure, resulted in low-skilled human resources and restricted environment for digital transformation. The article analysis the various data from the World Bank and other international organization to assess the level of network readiness and reveal the correlation with GDP and government expenditure on Research and Development.

La trasformazione verso il mondo digitale è la direzione moderna chiave dello sviluppo economico globale. La nostra società sta attraversando una fase di evoluzione qualitativamente nuova. Questa fase è caratterizzata dalla maggiore influenza delle tecnologie. La natura comune di queste tecnologie è la digitalizzazione, che sta cambiando la nostra vita quotidiana. Questi processi sono diventati ancora più evidenti e importanti nelle condizioni della pandemia di Covid-19. Le restrizioni legate alla pandemia hanno reso i governi, le imprese e gli individui profondamente consapevoli della necessità e dell'urgenza di implementare le tecnologie digitali nella vita di tutti i giorni il più rapidamente possibile. Di conseguenza, il processo di digitalizzazione del mondo ha subito un'accelerazione senza precedenti. L'articolo sottolinea le differenze tra il mondo sviluppato e quello in via di sviluppo in termini di velocità di digitalizzazione e livello di utilizzo delle nuove tecnologie. Le economie sviluppate con una conoscenza abbondante, una forza lavoro meglio formata con competenze digitali e un maggiore accesso a infrastrutture adeguate utilizzano e sfruttano le moderne tecnologie e una gamma più ampia di opportunità, rispetto ai paesi in via di sviluppo, caratterizzati non solo da un reddito basso, ma anche da una minore spesa per la ricerca e lo sviluppo, l'istruzione e le infrastrutture, hanno portato a risorse umane poco qualificate e un ambiente ristretto per la trasformazione digitale. L'articolo analizza i vari dati della Banca mondiale e di altre organizzazioni internazionali per valutare il livello di prontezza della rete e rivelare la correlazione con il PIL e la spesa pubblica in ricerca e sviluppo.

Received: January 2023
Published: 31/03/2023

Keywords: Digitalization, Economic Policy, Global Economy

“Nearly two years after the onset of COVID-19, one conclusion is clear —digital transformation has changed from a needed priority into a global imperative for all.”

Dr. Bruno Lanvin
Co-Founder of Portulans Institute
and INSEAD Distinguished Fellow

1 – Introduction

Our society is going through a qualitatively new stage of evolution. This stage is characterized by the greatest influence of technologies. The common nature of these technologies is digitization, which is changing our daily lives. These processes have become even more noticeable and important under the conditions of the Covid-19 pandemic. Pandemic-related restrictions have made governments, businesses and individuals acutely aware of the need and urgency to implement digital technologies into everyday life as quickly as possible (Guitton 2020). As a result, the process of digitalization of the world has accelerated unprecedentedly.

Against the rapid digitalization, especially during Covid-19 Pandemic period and even after, just, approximately, 60% of the world population have access to the internet and can utilize opportunities offered by the digital technologies ((ITU 2020, NRD Report 2021 p. 8). Number of countries have difficulties and face obstacles to use full benefits of digital equipment due to limited development, non-relevant infrastructure, fragmented regulatory legislation, inadequate education, and skills’ development institutions. No wonder to note, that developed economies with abandoned knowledge, better-trained workforce with digital skills and greater access to appropriate infrastructure utilize and exploit modern technologies’ wider range of opportunities, than developing countries, which characterized not only by low income, but as well by less expenditure on Research and Development, education and infrastructure, resulted in low-skilled human resources and restricted environment for digital transformation (Beaunoyer 2020,, Büchi *et al.* 2018). Moreover, the digital inequality exists not only among countries, but within the country boundaries. More concretely, digital inequality arises among rural and urban, poor and well-of part of society. Such conditions create the situation when benefits of digitalization are not distributed and spread equally within the societies and across the world, among countries.

Taking into consideration above-mentioned digital inequality, it is vital to define the gaps and difficulties to internet access and usage of new technologies among countries. Barriers and obstacles such as lack or less developed physical infrastructure, geographical limitations, and digital knowledge and illiteracy support to the digital inequality. National governments together with International Organizations, NGOs and business society should take measures to narrow the existing gaps and increase usage on ICTs and access to internet by all groups of society to ensure that the outcomes and benefits disseminate evenly.

In this regard, the core and key for government strategies and policies dedicated to the digital transformation is to first identify and then address these inequalities by means of targeted actions that will further encourage digital driven growth, both sustainable and inclusive. This will lead to better opportunities of economic and social development (Gazzola, P 2019, Riva, A., & Pilotti L. 2021).

After the two year of pandemic, major economies direct huge bulk of fiscal support to recovery processes. These financial resources for recovery packages amounted more than 12

trillion USD (OECD 2021). The EU mobilized 2.018 trillion EUR by help of Next Generation EU Recovery Instrument to support economic and social recovery of Covid pandemic affected spheres (European Commission 2021).

Four main areas are commonly defined likely to accept the fiscal support:

1. Health as the medical issues are still highly vulnerable and sensitive.

2. Greening of the economy as the significant decrease of economic activity during the pandemic displayed the possible impact that production and consumption have on the Environment.

3. Infrastructure development as the need for modernization is vital.

4. Digital transformation transforming the strategies of digitalization from a “priority” to the most important one become the dominant topic in numerous economic and social recovery packages.

Thus, supporting digital economic expansion and creating appropriate ecosystem for its development are the key issues among development program priorities for national policy-makers. Consequently, the present paper studies and analyze the relationship and correlation between ICT development and national economic development as well as discuss the meaning and importance of higher educational institutions, productivity, company strategies, competitiveness in global markets etc. The paper characterizes and estimates different determinants of measuring tools to evaluate and determine national strategy for digitalization leading to higher level of countries’ welfare.

2 – Literature review

Recent estimates showed that, 6.5% of global gross domestic product (goods and services) is produced by means of new information and communications technologies (ICT). In 2015, almost 100 mln employee work in the sector. ICT services export growth reached 40% in the period of 2010-2015. Global volume of e-commerce sales reached \$25.3 trillion in 2015 (Kwilinski, 2018, p. 8).

In contemporary global development, digital technologies force business to adapt novelties to survival in the transformed global industrial space against the tough international competition (Dimchenko 2021, Sepashvili 2019). Digital technologies dramatically reduce the cost of business operations and transactions, and thus, significantly improve the efficiency of economy. Unprecedented spread of digital enterprises entails new practice of social, mobile, analytics and cloud (SMAC) technologies to achieve greater productivity. At the same time, unprecedented growth of digital consumers, in its turn, boost even wider usage of SMAC technologies and thus, lead to a new era of digital economy and digital world (Gazzola *et al.* 2022, |Gazzola *et al.* 2020, Gogorishvili 2019, Mermanisvili 2019).

No wonder that the importance of ICT to the advancement of the national economies and its role in developing process have been gradually increasing. Such situation generates new possibilities and horizons for economies (Nasko, 2004). The reason directing governments’ and business’ interest towards ICTs is simple: using the new information technologies increases productivity. Thus, the objective are to make the better use of it to have greater impact on economic growth and to discover the ways to progress information ecosystem infrastructure (Biagi, 2013, Gazzola 2019). However, increasing of resources efficiency depends rather on usage

of knowledge and technology than on simple existing of well-equipped higher educational institutions and/or highly skilled workers (Sepashvili 2018). Thought ICTs have progressively converted socio-economic progress being one of the main features of affecting development and resulting institutional, structural and organizational changes. Such change demands the development of human capital (Njoh, 2018).

Science development in the field of ICT occurs almost on a daily basis. In this marathon governments, business, firms, and individuals are attaching values for their goods and services in completely new ways to compete and gain profit (Sepashvili 2020, Hyvönen, 2018). In Industry 4.0 era, digitalization relies on process optimization through creating value and focuses on capabilities, which support the whole business idea (Schallmo and Williams, 2018). The positive correlation of ICTs and economic growth led to widespread of new information technologies in business and growing support from the governments. Currently, this process of formation new structure caused transition from industrial society to digital economy (Zhu, 2019). Modern 4th industrial revolution is heavily based on ability of business and government to manage digital transformation (Pereira& Romero, 2017). This global need and demand equally bother developed and developing countries seeking to find ways to easily and broadly adjust to Digital Economy (DE). This new demand requires modernization of ecosystem and devoting huge volumes of investments (both public and private) to creation relevant infrastructure (Amuso, Poletti, & Montibello, 2019, Gogorishvili 2021).

The directions leading to digitalization of the economy are diverse and include many different interconnected formats exploiting ICT, electronic devices, and the Internet. Digital platforms based on internet use and consequently, assess to the internet accompanied with appropriate infrastructure are crucial components of business exchange that form modern market mechanisms (Richardson, 2020). Therefore, support to creation of new ICTs technologies and related inventions is key for any country development strategy (Park, 2017). Gradually and steadily, digitalization touches the business making style and alter the traditional form of company performance. Simultaneously, new conditions untapped new sectors and opportunities for modernization (Nambisan Wright, & Feldman, 2019). These new business models give additional competitive advantages even to small and medium business to participate in international markets and compete globally (Bedianishvili 2021, Mermanishvili 2020). Competition occurs on global level and companies must utilize ICT based advantages to create distinguished strategies. In this process country strategies and characteristics of national expenditures on research and development is key to handle national companies such kind of competitive advantages that is difficult by foreigner reveries to overcome. (Sepashvili 2020).

3 – Measuring the difference: need for comparison

3.1 – The impact of innovations and ICT on national welfare

In recent decade, scientists and policymakers begin to measure the impact of innovations and ICT on national welfare. Many researchers estimate the volume of Gross Domestic Product, though this does not give clear and full picture of the comprehensive effect of the technological advancement of the country (Mella 2019, Degryse, 2016). However, GDP per capita and its rate of growth is essential to support ICT development and digitalization. Still, effectiveness of whole educational system, from basic education level to higher education and research institutions, service sector and government management, in significant degree,

explains higher level of digitalization on developed countries (Vesperi & Gagnidze 2021, Lekashvili 2021). Researchers find out that urban population and their age have positive correlation with ICT adoption in developed countries and negative correlation exist between costs of internet and ICT adoption in developing countries (Billon *et al.*, 2009). This finding is important standpoint for developing countries to develop correct direction of priorities in terms of supporting national strategy toward digitalization.

Just a slight glance on statistical data shows that innovation development and ICT are spreading unevenly in favor of developed countries. ICT advanced development, key leaders and essential competences are naturally presented in developed countries (Doong & Ho, 2012, Foster & Azmeh, 2019). Nevertheless, developing countries, like developed countries try to suggest their own policy approaches to support digitalization on national level. Of course, it has a sense to evaluate countries' progress relative to each other in order to reveal the most significant gaps and discover the factors that are important to develop digital economy in countries that are lagging.

In order to stimulate modern socio-economic evolution, states have to develop digitalization strategies to help national companies to compete in information environment. This means government policies should encourage and in many cases support development of the factors such as education, research, infrastructure, cyber security and est. and adequately answer new demands of digital developments (Dimchenko *et al.* 2021, Sepashvili 2021). Worth to mention that, not only national governments but international organizations also have special approaches for digitalization (Linkov, Trump, Poinsatte-Jones, & Florin, 2018).

Long-term policies are essential for transition to digital economy. At the same time, it is necessary to monitor progress and measure the results, how countries fulfill the indicators or reach the targets. International ratings are often used to evaluate the progress by different countries. As a rule, such kind of ratings include numerous particular parameters.

3.2 – Methods of measuring the level of digitalization

Year by year methods of measuring the level of digitalization of the economy are multiplying and the results are improved. Though, objectively problems remain in certain sense, as the process is multidimensional and is characterized by rapid progress in the field. Some scientists point on the problem of using traditional macroeconomic data, like GDP and complications raised by the calculating the whole value of digital goods and services (Brynjolfsson & Collis, 2019). Some of them suggest analytical tools (Ahmad & Ribarsky, 2018) and some relies on statistical data analyzing methods (Bukht & Heeks, 2018) to measure the level of digitalization.

Many indicators and showing are used to measure digitalization as the impact of industrial 4.0 development are comprehensive and wide. Different international organizations, such as UNCTAD, OECD, World Economic Forum, International Monetary Fund, measure different indicators and use diverse methods. Their measurement and rating can be served as a foundation for national strategies and international policies. The common for such indicators is to look at different component of the digital economy and try to estimate the level of its development.

Some authors (Ershova *et al.* 2018, Kuzovkova *et al.* 2019) clarify three main groups of components that is necessary for digitalization and defines the degree of digital transformation. These indicators are:

1. **INFRASTRUCTURE** – meaning widespread of internet network and mobile telephone coverage as well as percentage of people using them. This indicator includes security of internet and cyber services.

2. **DIGITAL OPENNESS OF THE ECONOMY** – meaning the level of ICT industry development within the country and ability of national companies to export high-tech goods and services in international markets. It can be measured as share of high-tech exports in overall volume of manufactured goods exports and ICT related product export share in whole volume of country's export.

3. **INNOVATION ENVIRONMENT OF THE ECONOMY** – meaning the quality of educational system emphasizing the enrollment rate in higher education institutions, governmental expenditures on Research and Development, availability, and usage of the modern and innovative technologies.

On 9 March 2021, the European Commission (European Commission, 2019) issued the communication “*2030 Digital Compass: The European Way for the Digital Decade*”, where the objectives of Europe's digital transformation by 2030 were presented. The proposed Digital Compass suggests four cardinal points to around which the EU member states are to develop their strategies to achieve the targets. These are the following areas of action:

a. **SKILLS** – Basic digital skills development for all citizens and creating opportunity to obtain new digital skills for the workforce are one of the targets in the Digital Decade. The target is to increase population share with at least basic digital skills up to 80% by 2030 and ICT specialist number up to 20 million with balanced gender representation.

b. **SECURE AND SUSTAINABLE DIGITAL INFRASTRUCTURES** – building a sustainable digital infrastructure with ability to conduct operations with vast data needed for other technological processes forming sound foundation for competitiveness represent the second pillar for EU Digital Decade. The focus is on creating sustainable next generation satellite and mobile connectivity, with Very High-Capacity Networks including 5G to be presented everywhere. This target also envisages to substantially, as up to twice, increase, EU share in global production.

c. **DIGITAL TRANSFORMATION OF BUSINESSES** – latest rapid development of using ICT technologies due to the COVID-19 pandemic restrictions vividly showed that business have to adopt new technologies as soon as possible to pave the way to more success. Big data processing, robotics, Artificial Intelligence, I-cloud process will be the part of future products. In this regard, digital transformation of businesses operation is crucial to ensure the swift move towards the Digital Single Market in the EU. By the 2030 the third target is to achieve that 75% of EU based companies are using ICT technologies including, Cloud, AI, or/and Big Data. Grate majority of SMEs, up to 90% should reach at least an elementary rate of digital intensity.

d. **DIGITALIZATION OF PUBLIC SERVICES** – the fourth objective is to insure by 2030 that key public services are 100% on-line, as well as absolute majority of citizens (100%) have access to e-medical records and 80% of citizens use digital ID. Government should guarantee digital environment, with high standards of privacy and security to enable citizens to practice e-voting to support better participation in democratic processes and thus influence government. This target envisages easy access to public services based on digital technologies such as AI, data processing and est.

Since 2001, the World Economic Forum estimates factors that drive ICT development and estimate network readiness index. The numerous indicators, that are used to measure the level of Network Readiness, form *four* main directions:

1) TECHNOLOGY – to evaluate the degree of technological development, including relevant infrastructure and its affordability. This indicator determines countries' participation in the global economy.

2) PEOPLE – to show the level of skills and ability of individuals to fully exploit advanced technologies for productivity growth. This indicator incorporates the level, how much the governments, businesses, and individuals are using ICTs.

3) GOVERNANCE – to calculate government expenditure and support to creating favorable the national environment to digitalization, including networks, and regulations security issues.

4) IMPACT - to evaluate the upgrading of the welfare of society via participation in digital economy. Indicators deal with education, health, environment, and contribution to achieving the SDGs.

This slight overview of different methods of measurement of digitalization shows that, despite variances in selecting showings, the focal point are following:

1. how the technologies develop,
2. what is the supporting factors,
3. how business and people use the achievements and opportunities suggested by innovation.

3.3 – *The Network Readiness Index*

In this regard, government expenditure on Research and Development and internet coverage as well as affordability of electronic devices represents utmost influences for digital transformation. Therefore, we try to measure these aspects of digitalization by means of relevant indicators presented below. For comparison, we look through the data for several countries. Netherlands, Sweden, Denmark, and Singapore were chosen because their top position by Network Readiness Index (see Table 1), some advanced and East EU member states were selected to outline the general picture in the EU and Eastern Partnership countries together with regional countries were selected to better understand supportive factors in developing countries.

The Network Readiness Index positioned 121 countries in 2019, 134 economies comprising 98% of global GDP (NRI 2020) and ranked 130 countries in 2021. Sweden moved to the second position after being on the first position for the two years, in 2019 and 2020, correspondently. Netherlands made the significant movement from the 4th position in 2020 to the first place in 2021 and occurred as the most network-ready state. The US made even more impressive move from the 8th positions consequent two years in 2020 and 2019, towards the 4th in 2022. Top 10 performers in terms of NRI are mostly the western advanced economies of Europe and Americas. 17 Northern and Western European countries lead the list of top performance countries.

Table 1 – Network Readiness Index

(Source: The Network Readiness Report 2019, Portulans Institute; The Network Readiness Report 2020, Portulans Institute; The Network Readiness Report 2021, Portulans Institute)

Country	2021		2020		2019	2016	2015	Income level
	Rank	Score	Rank	Score				
Netherlands	1	82.06	4	81.37	3			High-income
Sweden	2	81.57	1	82.75	1	3	3	High-income
Denmark	3	81.24	2	82.19	6	11	15	High-income
US	4	81.09	8	78.91	8			High-income
Singapore	7	80.01	3	81.39	2	1	1	High-income
Germany	8	78.95	9	77.48	9	15	13	High-income
France	14	74.79	17	73.18	18	24	26	High-income
Japan	16	73.92	15	73.54	12	10	10	High-income
Estonia	21	71.62	23	70.32	23	22	22	High-income
Italy	28	66.25	32	63.69	34	45	55	High-income
Lithuania	30	65.32	29	64.70	31	29	31	High-income
Slovakia	35	62.45	35	60.78	35	n/a	n/a	High-income
Latvia	36	62.16	37	60.47	39	32	33	High-income
Russian Fed.	43	57.74	48	54.23	48	41	41	Upper middle-
Turkey	45	56.88	57	51.24	51	48	48	Upper middle-
Bulgaria	50	56.17	46	55.03	49	69	73	Upper middle-
Ukraine	53	55.70	64	49.43	67	64	71	Lower middle
Armenia	60	52.51	55	51.91	62	56	58	Upper middle-
Belarus	n/a	n/a	65	49.16	61	n/a	n/a	
Georgia	68	49.10	68	47.95	68	58	60	Upper middle-
Moldova	69	49.07	71	47.09	66	71	78	Lower middle-
Azerbaijan	76	47.56	66	48.76	70	53	57	Upper middle-

Germany just slightly improved the position, advanced by one position and moved from the 2020-2019 9th place to the 8th in 2021. Singapore fell from 3rd place to the 7th in 2021. France, Italy and Bulgaria are steadily improving their positions: France ranked 26 in 2015 and slowly improved the positions and reached 18th place in 2019 and 14th in 2021, demonstrating excellent

progress. The gradually positive development was also observed in Italy being at 55th place in 2015, moved to 34th in 2019 and reached the 28th position in 2021. Bulgaria moved from the 73rd place in 2015 to the 50th in 2021. Worth to mention, that among these increasingly improving countries Italy had shown the most impressive advancement in regard with network-ready economy.

Baltic States demonstrated slow and uneven progress over these years. Estonia is the most advanced in network readiness sense, holding 22nd position in 2015 and just one position advanced in 2021, holding 21st position. Lithuania has the same situation, but its position was 31st in 2015 and reached 30 in 2021. Latvia showed regress from 33rd position 2015 to the 36th position in 2021. However, Latvia had the worse position in 2019, holding 39th position and made little progress in 2020-2021 years. Eastern Partnership countries progress is very uneven and varies according to years. The steady progress is observed on with Moldavian case. The country held the 78th position in 2015 and moved to the 69th position, though in 2019 was positioned at 66th place. Ukraine is at the most advance performer among EaP countries, holding 53rd position for the year of 2021. The country showed steady progress during the years, moving slowly from the 71st position in 2015 and made significant progress in recent years.

In 2020-2021 Ukraine advance by 11 positions, and jumped from 64th place to the 53rd place. Armenia is also at the top among these countries holding 60th position in 2021, though had the better positions in previous years and the best position, 55th place, was noted in 2020. After it, the country experienced regress and step back by 5 positions and held 60th place in 2021. Georgia showed regress in comparison to the 2015 year's 78th place to the 68th position in 2021, though this place is maintained during the last three years. Azerbaijan also regressed the network readiness state of the country from the 53th place in 2016 to the 76th place in 2021.

3.4 – Indicators of the level of digitalization

To identify the achievements of the countries, other indicators were selected for measurement. We choose those indicators, which are directly connected to the level of digitalization. First of all, we selected such showings, as the number of individuals, who uses the internet (as percentage of whole population) to picture the level of utilization of the internet network. We also interested in the number of mobile cellular subscription (per 100 people) in order to have an idea about the distribution of e-devices (the most common one) among population. Another important indicator, which can be used for assessing the level of digitalization, is the High Technology Export as present of total volume of manufactured goods export. ICT product export as the percent of total product export also were taken for comparison. Due to a huge role, the government is playing in supporting the digitalization, government expenditures on Research and Development were seen as well. As the level of digitalization is closely connected to the level of countries development and economic growth, consequently GDP per capita is presented in the Table 2. A quick glance at the Table 2 generally confirms the main conclusion that the well-developed counties have better showings in regard with chosen indicators. However, some interesting picture still can be outlined. Some EaP countries' (Belarus Georgia, Ukraine) populations subscription to the Mobile cellular is higher, 124, 128 and 129 correspondently, than the EU average 121 per 100 people. This situation is little bit surprising if we look at those countries NRD index rank which notes huge gap. Belarus had 65th place in 2020, Georgia 68th and Ukraine 53rd places in 2021 meanwhile 17 EU member state are among 25 best performers from network readiness point of view as NRD 2021 report notes.

Table 2 – Indicators of Digitalization (Source: World Bank Data. For GDP per capita current US: UNESCO Institute for Statistics (uis.unesco.org), June 2022)

Countries	Information infrastructure/digital economy infrastructure		ICT utilization		Innovation environment	GDP per capita current US \$ 2021
	Individuals using the internet (percentage of population) 2020	Mobile cellular subscription (per 100 people) 2020	High technology export (% of manufactured goods export) 2020	ICT product export (% of total product export) 2020	R&D (research and development expenditures as % of GDP)	
Armenia	77	118	7	0.4	0.21	4 670
Azerbaijan	85	102	7	0.1	0.22	5 384
Belarus	85	124	5	1.0	0.55	7 303
Bulgaria	70	114	11	3.2	0.85	11 635
Czech	81	121	23	17.9	1.99	26 379
Denmark	97	125	13	4.0	2.96	67 803
Estonia	89	145	20	9.5	1.79	27 281
France	85	111	23	3.8	2.35	43 519
Georgia	73	128	2	0.4	0.30	5 042
Germany	90	128	15	5.1	3.14	50 802
Italy	70	128	9	2.2	1.53	35 551
Japan	90	154	19	8.9	3.26	39 285
Latvia	89	109	20	10.9	0.71	20 642
Lithuania	83	135	12	3.9	1.16	23 433
Moldova	76 (2017)	85	2	0.2	0.23	5 315
Netherlands	92	125	23	11.2	2.29	58 061
Russia	85	164	9	0.5	1.10	12 173
Singapore	92	144	55	33.7	1.89 (2019)	72 794
Slovakia	90	134	10	13.0	0.91	21 088
Sweden	95	127	15	6.6	3.53	60 239
Turkey	78	97	3	1.0	1.09	9 587
Ukraine	75	129	6	0.7	0.41	4 836
US	91	106	19	9.7	3.45	69 287
WORLD		106	22	14.3	2.63	12 263
EU		121	16	5.1	2.36	42 308
EU AND CENTRALASIA		125	16	0.8	2.11	27 114
OECD		117	18	7.6	2.95	42 098

Singapore is leading country in terms of high technology export that comprise 55% of its total manufactured goods export and ICT product export that reaches 33,7% of entire product export. These showings are significantly exceeding the similar showings of the top NRI rankers, like Netherlands, Sweden, Denmark and US, whose high technology export as present of manufactured goods exports are 23%, 15%, 13% and 19% accordingly; and ICT product share in total product export are 11,2%, 6%, 6% 4,0% and 9,7% accordingly; Estonia and Latvia demonstrate respectable results in regards of these showings. Namely, both have 20% of high technology export share meanwhile Germany has just 15%, Italy 9% and France's case slightly exceeded and comprise 23%. No wonder that EaP countries are heavily lagging behind by this indicator. Azerbaijan and Armenia export 7% of high technology product, Ukraine 6%, Belarus 5%, Georgia, and Moldova, both 2%.

Interesting picture is explored in regards with R&D expenditures. Despite the fact that the Singapore is the leading country in terms of high tech and ICT product export, its share on R&D is just 1,89% of GDP. Meanwhile Sweden (3.53%), US (3.45%), Japan (3.26%), Germany (3.14%), spent more than 3% of their GDP on R&D. Estonia and Latvia which are leaders in terms of high technology and ICT product exports, spent relatively less, 1, 79% and 0.71% correspondently. Among EaP countries, Belarus is spending the biggest share of its GDP on R&D, 0,55%. Armenia is spending the less - 0.21 %, though this number does not exceed in great extent the showings for other EaP countries. Azerbaijan spends 0.225, Moldova - 0.23%, Georgia - 0.30%.

Network readiness by pillars such as technology, people, governance, and impact, (Table 3) give divers picture. Generally, development according to the different pillars of NRI expose uneven development in regards with each pillar. In terms of impact on the country development, Singapore remains as leader during past two years, 2020 and 2021. As for technological development, US is leading country in 2021, though the impact on the country development level is assessed at the 16th position. The less impact on the country development among our selected countries is observed in Georgia (80th place). As for technological development, Ukraine is leader among EaP countries holding 50th position in this pillar. However, the impact of Ukraine's economic development is evaluated at 64th position.

One of the strongest indicators of NRI performance is a country's income level. The data of both Tables prove a substantial and strong constructive correlation between digital readiness and GDP per capita. As data displays NRI ranks upsurges alongside with income level. The top NR performers are mainly high-income economies, whereas the bottom NR economies are typically low-income economies. Surely, lower-middle-income and upper-middle-income countries placed in between. Nevertheless, despite the vivid correlation, government spending on R&D as % of GDP reveals, that juts volume of financial resources that are directed to research and innovations is not itself the only factor that support country's digitalization level upgrading.

As statistics show in the Table 2, some countries with less spending on R&D, still hold higher positions in NRI rank in contrast with other countries. For instance, Singapore is spending just 1,89% of its GDP, but is ahead of such countries as Germany, France, which spend on R&D much higher present of their GDP, 3.14%, and 2,35% accordingly. Estonia (21) which significantly goes far from Italy's position (28), has spent on R&D 1,79% of its GDP just meanwhile Italy dedicated 1.53% to science development. Worth to note, that the GDP per capita in Estonia is 27 281 US\$ and in Italy – 35 551 US\$. Russia (43) and Turkey (45), having significant progress since 2019 in terms of NRI rank, though spent smaller portion of their GDP

on R&D, namely, 1, 10% and 1.09% correspondently. Thus, if we have a glance at GDP per capita level of these countries – and compare with the rank's countries hold, assumption is simple: clearly, economy of the scale does matter. This conclusion lives space for further consideration for policy makers.

Table 3 – Network Readiness Rank by Pillars

(Source: The Network Readiness Report 2019, Portulans Institute; The Network Readiness Report 2020, Portulans Institute)

Countries	Pillars' rank in 2021					Pillars' rank in 2020				
	rank	technology	people	governance	Impact	rank	technology	people	governance	Impact
Netherlands	1	3	7	2	3	4	3	9	3	4
Sweden	2	4	4	5	2	1	2	4	4	3
Denmark	3	7	2	3	7	2	5	1	2	5
US	4	1	5	7	16	8	4	7	8	14
Singapore	7	8	9	12	1	3	10	5	13	1
Germany	8	5	8	13	10	9	7	12	12	7
France	14	14	14	16	14	17	18	20	15	12
Japan	16	16	11	24	15	15	21	6	23	11
Estonia	21	27	23	9	12	23	24	21	11	29
Italy	28	26	28	31	35	32	30	36	33	28
Lithuania	30	40	26	20	33	29	32	23	21	39
Slovakia	35	38	51	30	30	35	34	49	30	35
Latvia	36	41	52	27	32	37	38	39	28	42
Russian Fed.	43	39	35	54	51	48	49	31	65	60
Turkey	45	46	31	48	74	57	58	53	48	81
Bulgaria	50	56	50	47	48	46	43	55	44	52
Ukraine	53	50	48	57	47	64	62	65	58	79
Armenia	60	58	47	72	60	55	42	42	76	65
Belarus	n/a	n/a	n/a	n/a	n/a	65	68	62	71	56
Georgia	68	77	67	65	80	68	59	63	64	94
Moldova	69	89	74	67	55	71	74	69	74	66
Azerbaijan	76	62	77	88	77	66	60	57	87	58

Table 1 and Table 2 data clearly demonstrate that advanced economies are leaders in the NR index positions, including the performance in the four pillars of the NRI: Technology, People, Governance, and Impact. No wonder, that technologies have substantial positive impact on

national economic developments and on their capacity to adequately face the SDGs. But to achieve such kind of level, the efficient government institution has to be in place to back the introduction of technologic achievement with the three key stakeholders – governments, businesses, and individuals.

4 – Conclusion

The development of new technologies is defining the nature of the XXI century global economic development. This new digital model of economy changes social and economic objectives of nations as well as nature of business operation. Therefore, digital transformations are widely occurring in the strategies of international business and marketing.

The urgent need for rapid digitalization was accelerated by the restrictions imposed by Covid 19 pandemic requirements clearly exposed the disparities in term of countries' abilities to face and answer digital necessities. Economies over the globe are all the different stage of the digital transformation. Moreover, their economic policy priorities are varying and therefore, creating diverse picture of digital global pictures. Hence, no wonder that despite the fact that digitization is influencing everywhere and everything; the benefits it generates are disseminated unevenly.

The scientific and technological split is still a crucial concern at the global level. High-income economies prove the most future readiness in all dimensions and especially in technology. Obviously, the group of high-income countries leads the NRI rank. Due to the trend, that high-income countries have usually invested profoundly in their technological infrastructure and thus, improving both content and access, consequently, they keep better places and succeed in usage of the opportunities that are offered by technological achievements and innovations. Taking into account such situation in highly developed countries, less developed countries have to make better use of their resource and encourage digital eco-system development.

More accurate overview and assessment of the different factors of digital transformation is required to reveal the potentially weak spheres, where developed countries need more afford not to lag behind the ICT development trends and where developing countries have to pay primarily interest to develop basic infrastructure and boost human capital in the field. More deliberated wide valuation should be done by national governments in order to develop appropriate national policies, which will address multidimensional requirement of different actors, such as science, education, expenditure on R&D, government services, firms' strategies, individuals and etc. Distinct attention should be paid to cooperation and experience sharing between and among countries, which are on diverse level of development, where international organizations have their prominent role to play and at the same time national policies have to adequately address the problem of disparities between urban and rural, rich and poor, well-of and socially venerable parts of society.

5 – References

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