

The Impact of Digitalization on Life Quality in EU Member States

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Abstract

Digitalization is an evolving phenomenon that affects almost every aspect of human life. Nevertheless a significant number of scientific publications examine the impact of digital technologies on the productivity and gross domestic product (GDP) of countries while their impact on individuals' life quality is understudied in scientific literature. For this reason, the purpose of this article is to analyze the relationship between digitization and life quality in European Union (EU) member states. The Digital Economy and Society Index (DESI) is used as a measurement of the level of digitalization, and the Quality Life Index (QLI) of NUMBEO is used as a measurement of the life quality. The study period is 2019-2022. The relationship between DESI and QLI as well as DESI and QLI's components is analyzed by K. Pearson's coefficient. The research's guiding hypothesis, which states that there is a relationship between the level of digitalization and life quality as well as between the level of digitalization and some of QLI's components, is proven.

Keywords: digitalization, digitization, life quality, Pearson correlation analysis, EU member states.

JEL: I31; O33; O52.

Introduction

Digitalization is a phenomenon in development, which has not only purely production directions of application, but has an impact on society in a multidimensional and complex way. In parallel with these new areas and aspects of the digitalization's impact have arisen, which have a significant economic and social effect. All this together with the need to manage the process explains both the significant research interest from the academic society and the increased interest of policymakers. Because of these reasons during the last decade the European Commission has sought to accelerate Europe's digital transformation through the adoption of strategic documents such as the Digital Single Market Strategy for Europe (2015), Shaping Europe's Digital Future (2020), the European Union's Cybersecurity Strategy for the Digital Decade (2020) and the Policy programme "Europe's Digital Decade: digital targets for 2030" (2021) etc.

Obviously the identification of the directions and degrees of impact of digitalization on the

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economy and society is an undeniably topical and pressing problem. An indirect assessment of its significance are the provided financial means and tools for realization of digital transformation. In this regard for the implementation of the digital transformation in the EU member states, financial resources have been provided the amount of which is minimum 20% from the funds planned in their National Recovery and Resilience Plans (Communication from the Commission to the European Parliament, 2021).

Identified and unanimously accepted at the political level are some priority areas, which are outlined through the objectives of the program “Europe’s Digital Decade: digital targets for 2030”. They are in four dimensions: digital skills, digital infrastructure, digitalization of business and digitalization of public services (Communication from the Commission to the European Parliament, 2021). The progress towards the attainment of the goals set in the “Digital Decade” political program of the EU member states is measured through the index for the spread of digital technologies in the economy and society (Digital Economy and Society Index (DESI)) (European Commission, 2022).

It should be noted that the above-mentioned priority areas in the program “Europe’s Digital Decade: digital targets for 2030” have an impact on people’s life quality. This is natural as in the modern world almost every aspect of human life is affected by digital technologies. Nevertheless a significant number of scientific publications examine the impact of digital technologies on the productivity and gross domestic product (GDP) of the countries (Arsić, 2020; Mikalef, Parmiggiani, 2022), while their influence on the individuals’ life quality is insufficiently studied in the scientific literature. Taking into account the increasingly

important role of digital technologies in people’s daily life the study of the impact of digitalization on the individuals’ life is of great significance (Ali, Khorshed, Taylor, Shuddhasattwa, 2020). In this connection, O. Kryzhanovskij, N. Baburina, A. Ljovkina (2021) emphasize that digitalization is one of the key factors for human development influencing both objective life quality indicators and subjectively perceived ones. Moreover digital technologies have serious potential to improve the life quality as they provide many and varied opportunities for human development. Due to this the goal of this article is to analyze the relationship between digitalization and life quality in EU member states.

1. Literature Review

In specialized literature and different strategic documents, the concepts of digitalization, digitization and digital transformation are not always unambiguously defined and are often incorrectly used as synonyms. Because of that in order to clarify their essence in the following lines the understandings of some authors are briefly presented. According to some researchers digitization is the process of analog information transformation into digital bits so that computers can store, process, and transmit that information. (Orekhov, 2020; Parviainen, Kääriäinen, Tihinen, Teppola, 2017). A distinction between the concepts of digitization and digitalization is done in the study of J. Reiss et al. according to which “digitalization is a phenomenon of transformation of analog data into digital language (i.e. digitization), which in turn can improve business relationships between consumer and company, producing value added for the entire economy and society as a whole” (Reis, Amorim, Melão, Cohen,

Rodrigues, 2020). In this line of thoughts V. Aloulou points out that unlike digitization, which is a technical process, digitalization is a socio-technological process in which digital technologies are applied in a broad socio-economic and institutional aspect (Aloulou, 2019). They are changing society and business in short and long terms period of time (Tátraí, Szabó, 2020) and contribute to the higher efficiency of the economic system (Osipova, Naumova, 2020). The opinion of T. Atanasova et al. (2020) is not significantly different from the above mentioned. The authors point out that digitalization begins with the fourth technological revolution and creates new business models, commercial and social relations, new products, and as a whole generates higher productivity and living standards. On the grounds of the presented till know, in the current paper, digitalization is understood as the application of digital technologies and digital data in all possible spheres of society, including the economy, which increases the efficiency of the economic system. At the same time in the digital transformation the organizations take advantage of the integration of digital technologies into their activities to change their business models, improve routine work processes, explore new revenue opportunities, and ensure sustainable value creation (Gimpel, Hosseini, Huber, Probst, Röglinger, Faisst, 2018). Similar understanding is asserted by other authors' teams who perceive digital transformation as a process whose goal is to improve the functioning of particular organization on the basis of significant changes in its characteristics as a consequence of the use of combination of digital technologies (Fitzgerald, Kruschwitz, Bonnet, Welch, 2014; Liere-Netheler, Packmohr, Vogelsang, 2018; Mikalef, Parmiggiani, 2022). From presented

till know, considering the concept of digital transformation, in the current article the thesis of A. Shopov is accepted, and namely: "integration of new digital technologies in all spheres of business, leading to a fundamental change in the way in which the organization is working" (cited by T. Atanasova et al., 2020).

Digitalization has a positive impact on the economic growth of national economies (Myovella, Karacuka, Haucap, 2020) and hence on the material well-being of large groups of people and at the same time ensures higher competitiveness at firm and national level (Boikova, Zeverte-Rivza, P. Rivza, B. Rivza, 2021). In addition to the material well-being of individuals digitalization has also a positive impact on some non-material dimensions related to the life quality as a result of providing the so-called "free" goods in fields as: education – its gradual digitalization provides educational opportunities for everyone, which makes education accessible, cost-effective and inclusive; the digitalization of cities allows monitoring of city life through cameras, sensors and other digital devices, which allows control over some events related to traffic, crime, environmental pollution as well as making effective decisions to improve the functioning of cities; science – digital technologies speed up calculation processes and analyses, save time for routine activities and provide access to an unlimited number of literature sources; health care – the digital technologies allow remote monitoring and control of the individuals' health and free information related to health care for disadvantaged people; they stimulate the trade through limitation of the influence of monopolies on the market price, etc. (Barlybaev, Ishnazarova, Sitnova, 2021; Ganju, Pavlou, Banker, 2016).

Considering the concept of life quality it should be noted that there is not a generally accepted and universal definition in the specialized literature. According to J. Ruževičius (2014), the life quality is influenced by individual's physical and mental health, the level of independence, social contacts with the external environment and other factors. According to N. Stoenchev (2016), "the quality of life is a complex characteristic for the degree of satisfaction of the individual with the opportunities to achieve his material, spiritual, professional, cultural and other goals and ideals. To a large extent it is related to the standard of living, but it also includes subjective self-estimation and is influenced by the value system, education, lifestyle, traditions and other national, religious or ethnic characteristics of the population". In contrast to the quality of life "the standard of living determines mainly the material prerequisites for achieving healthy and fulfilling people's life in biological as well as in social, spiritual and cultural aspects" (Stoenchev, 2016). From the definitions above the multifaceted nature of the category life quality is evident, which can be assessed on the basis of subjective and objective indicators (Diener, Suh, 1997). The scholars unanimously agree about the thesis that in order to assess people's life quality it is necessary to use both subjective and objective information (Cummins, 2005; Hagerty, Cummins, et al., 2001). On this basis complex indices for assessment of life quality as Human Development Index of the United Nations (UN), the Global Liveability Index of The Economist magazine, the European Quality of Life Surveys (EQLS) of the European Foundation for the Improvement of Living and Working Conditions, Quality of life index (QLI) of NUMBEO are developed.

The objectivity requires to emphasize that an except positive impact on some aspects related to the life quality, digitalization also has its negative effects on the individual and society as a whole in an economic, social and psychological aspect. These effects are related to: increasing cyber security risk; increase in uncertainty about personal life; increase in income and social inequality; increasing unemployment among lower skilled workers; emergence of a digital divide and digital inequality, which finds expression in unequal access to information and communication technologies (ICT) for different social strata of the population and countries at different levels of economic development; states of compulsive connectedness that is harmful to individuals' mental health, their creativity, ability to think analytically and concentrate; sometimes the lack of digital skills makes it difficult for individuals to adapt to digital technologies, reflects on their self-esteem, increases stress, anxiety, depression, insomnia and social isolation (Gimpel, Fabian, 2019; Ionescu-Felegă, Ionescu, Stoika, 2022; Konle-Seidl, Danesi, 2022; Kryzhanovskij, Baburina, Ljovkina, 2021; Ono, Zavodny, 2007; Petropoulous, Marcus, Moës, Bergamini, 2019; Pick, Azari, 2008).

In the specialized literature the impact of digitalization on life quality is most often studied on the grounds of regression and correlation analysis between complex indices reflecting the multidimensional nature of the two categories. For example O. Kryzhanovskij, N. Baburina and A. Ljovkina (2021) justify the use of the World Digital Competitiveness Ranking (WDCR) of the International Institute for Management Development (IMD) as an assessment of the level of digitalization in the conducted by them research in 61 countries in 2018. Considering the life quality the authors

use two indices. The first one is based on subjective and objective indicators and it is the Human Development Index (HDI) and the second is based on subjective indicators and presents the ranking of the countries by the level of happiness (RH) in the United Nations Sustainable Development Solutions Network's World Happiness Report. Through correlation analysis the authors measured the strength of the relationship between WDCR and HDI, as well as between WDCR and RH. It is established that the degree of dependence between digitization and life quality in both cases is strong with a positive relationship between the variables (WDCR and HDI; WDCR and RH). Nevertheless the authors defend the thesis that digitalization is an objective reality that allows expansion of the opportunities for life quality improvement in all its aspects, but only if the necessary attention is paid to education and training, culture, health care and equal development opportunities (Kryzhanovskij, Baburina, Ljovkina, 2021). Similar studies have been carried out independently from each other by different scientific teams. For example M. Tátrai and R. Zabo study the relationship between the level of digitalization measured by DESI and the life quality measured by QLI of NUMBEO. The data for both indices are for 2019 for 28 EU member states. Through correlation analysis the authors find that the degree of dependence between DESI and QLI is strong. The positive relationship between the two variables gives the researchers grounds to claim that digitalization improves the life quality (Tátrai, Szabó, 2020). The same conclusion is done by I. Osipova and T. Naumova. They examine the relationship between five quantitative indicators (health, standard of living, education, energy consumption and use) characterizing the life

quality and the level of ICT use in the Irkutsk Region of the Russian Federation during the period 2014-2017. As an indicator for the level of ICT application the researchers use ICT expenditures. The author's team finds a strong positive relationship between the level of digitalization and three of the applied indicators – education, healthcare and standard of living. This permits the author's teams to draw up a conclusion that there is a positive dependence between the quality of life and the use of ICT (Osipova, Naumova, 2020). Motivated by the limited number of studies on the relationship between the level of digitalization and the level of happiness in the EU member states, L. Ionescu-Felegă, B. Ionescu and O. Stoika (2022) conduct an analogous research for the period 2019 – 2021. As an assessment of the level of digitalization the author's team perceives DESI and for level of happiness' assessment – the World Happiness Index (WHI), which is based on data from the Gallup World Poll. Through a correlation analysis during the three years from the analyzed period the authors verify and accept as true the following working hypotheses: there is a positive relationship between DESI and WHI; there is a positive relationship between DESI and the variables included in WHI; there is a positive dependence between DESI and WHI for EU geographical regions (South, Central and East, West and North) (L. Ionescu-Felegă, L., B. Ionescu, O. Stoika, 2022). The relationship between the level of digitalization and life quality is also confirmed in research performed by K. Ganju, P. Pavlou and R. Banker. The study is based on an econometric model. The dependent variable in the model is the life quality, which is measured in 160 countries by Gallup World Poll during the period 2006-2014. Simultaneously the factor variables reflecting

the level of ICT use in the respective country are three: the number of landlines, the number of Internet users and the number of mobile phones per 100 people. It is found that the use of ICT has a positive effect on the well-being of the population. Nevertheless the researchers underline that not all effects of digitalization are positive. Because of that more researches are needed in the future on the impact of digitalization on people's well-being. At the same time the authors point out that in these future studies it is not necessary to put the stress on the relationship between ICT investment and GDP growth of national economies as this positive relationship has already been proven in numerous surveys (Ganju, Pavlou, Banker, 2016). The last is confirmed by the publications of J. Dedrick, V. Gurbaxani, K. Kraemer (2003), L. Mičić (2017), P. Schreyer (2000) etc.

From the lines above it is obvious that the impact of digitalization on the life quality is not still sufficiently well studied in the scientific literature. The significance of this problem motivates the authors of the present article to analyze and assess the relationship between the level of digitalization and life quality, which will enrich the specialized literature and help the managers in the decision-making process.

2. Methodology

In the present article analogously to similar researches presented above (see L. Ionescu-Felegă, L., B. Ionescu, O. Stoika, 2022; Tátrai, Szabó, 2020) the **DESI index** is used as an instrument for assessment of the level of digitalization. The reasons for that are the dimensions, which compose the index, and the approach for its calculation. Considering the first reason it should be noted that although constructed to measure the level of digital transformation in the EU member

states the scope of the index is continuously expanded by including additional indicators towards the four dimensions that composed DESI and recalculation of its values from the previous years with the added indicators. The recalculation is carried out in order to reflect the corrections in the database, to ensure comparability and to track the progress towards the goals of the Digital Decade in the EU Member States. In 2022 some additional sub-dimensions were added to the four dimensions that constitute DESI. In their wholeness they go beyond the essence of the concept of digital transformation and fully reflect the core of the category digitalization. As of 2022, the dimensions constituting DESI and the sub-dimensions included in them and presented in brackets are: Human capital (At least basic digital skills; ICT specialists; Female ICT specialists); Connectivity (Gigabit for everyone; 5G coverage); Integration of digital technology (SMEs with a basic level of digital intensity; AI; Cloud; Big data); Digital public services (Digital public services for citizens; Digital public services for business) (European Commission, 2022 b). The indicators included in the four dimensions that make up DESI are quantitative and from here their objectivity derives. It should be emphasized that the components of DESI are carefully selected and correctly reflect the digital performance and competitiveness of the EU member states, as well as the amount of government investments in the digitalization of the market participants' economic activities. Regarding the DESI's calculation methodology, it should be underlined that it overcomes the shortcomings of most global indexes, whose calculation approaches are based on the use equal weights (Ionescu-Felegă, Ionescu, Stoika, 2022). Something more DESI's calculation is based on

guidelines and recommendations in the OECD/JRC's Handbook on constructing composite indicators: methodology and user guide (Nardo et al., 2008) using the min-max method for normalizing the named quantities and simple weighted arithmetic averages for their aggregation. At the same time the fact that the data for the calculation of dimensions and sub-dimensions are reliable should not be underestimated as they are provided by the official authorities of the EU Member States (European Commission, 2022 a).

QLI of NUMBEO is broadly used to assess life quality (Tátrai, Szabó, 2020). It is accepted in the present article, as it is composed by 8 components weighted with different weights corresponding to their importance and largely reflects the multifaceted nature of the studied phenomenon. In this regard it should be underlined that the components of QLI are:

- Purchasing power index (PPI) (higher is better) – the index presents the relative purchasing power in a particular country on the grounds of the average net salary. The PPI of New York City (NYC) is the base for comparison and is 100% (https://www.numbeo.com/cost-of-living/cpi_explained.jsp);
- Safety index (higher is better) – it is on the opposite of the crime index, which characterizes the overall level of crime in a particular country (https://www.numbeo.com/crime/indices_explained.jsp);
- Health care index (higher is better) – it assesses the overall quality of the health care system. The index takes into account the professionalism of the medical staff, the quality of health services, the health infrastructure, the resources used and the health care's costs (https://www.numbeo.com/health-care/indices_explained.jsp);
- Cost of living index (lower is better) – this index reflects the relative prices of consumer goods in the respective country. The Cost of Living index for NYC is basic for comparison and is accepted for 100% (https://www.numbeo.com/cost-of-living/cpi_explained.jsp);
- Property price to income ratio (lower is better) – reflects the affordability of the real estates in a particular country for its citizens (https://www.numbeo.com/property-investment/indicators_explained.jsp);
- Traffic commute time index (lower is better) – it is a complex indicator that reflects factors as commuting time, disapproval with the time spent in traffic jam, carbon dioxide emissions etc. (https://www.numbeo.com/traffic/indices_explained.jsp);

Pollution index (lower is better) – takes into account air and water pollution, rubbish disposal, sound and light pollution, etc. Air and water pollution are considered by NUMBEO as the most dangerous (https://www.numbeo.com/pollution/indices_explained.jsp);

Climate index (higher is better) – the index is normalized between -100 and +100. Settlements with an index of 100 are characterized by moderate temperature and low humidity, i.e. climate preferred by most of the people (https://www.numbeo.com/climate/indices_explained.jsp).

It is indisputable that climate conditions have an impact on the life quality, but there is no logical direct connection between them and digitalization. This fact in addition to the different weights of the indices included in QLI, may have an impact on the final result from the correlation analysis. Due to this it is appropriate to survey not only the relationship between DESI and QLI, but also

the relationship between DESI and each of the eight indices that composed QLI. This should fill a research gap as the strength and direction of the relationship between DESI and QLI' components has not yet been explored in the scientific literature.

Similarly to the researches cited above the analysis in this paper of the relationship between DESI (factor variable) and QLI (dependent variable), as well as between DESI (factor variable) and QLI' components (dependent variables) is based on the coefficient of K. Pearson. It varies within the borders $(-1) \leq r \leq (+1)$ and is calculated through formula (1) (Stoenchev, 2013; Stoenchev, 2016):

$$r = \sqrt{1 - \frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{\sum_{i=1}^n (y_i - \bar{y})^2}} \quad (1)$$

where $\sum_{i=1}^n (y_i - \hat{y}_i)^2$ is the residual (random) deviation that derives from randomly acting factors;

$\sum_{i=1}^n (y_i - \bar{y})^2$ – the total deviation, which expresses the complex influence of systematically and unsystematically acting factors

It should be noted that the sign of the K. Pearson coefficient is determined by the sign of the regression coefficient. With a positive sign of the latter, the relationship is direct, and with a negative sign it is inverse. (Stoenchev, 2013).

3. Results and Discussion

The research period is 2019-2022. Its choice is based on the availability of reliable, comparable data, as well as on the possibility to verify for several consecutive years the hypothesis, which is guiding for the research. It states that there is a relationship between the level of digitalization and life quality, as well as between the level of digitalization

and some of the QLI' components. Here it should be emphasized that during the period 2019-2022 there are no QLI data for Cyprus, Luxembourg and Malta. Due to this the research is for 24 EU member state as of 2023, and namely: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherland, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden. The values of the K. Pearson coefficient are calculated through IBM SPSS Statistics and are presented in the table 1.

During the analyzed period 2019-2022 the dependence between the indices DESI and QLI is strong and positive, and the values of the correlation coefficient (r) in chronological order are as follows: 0.834; 0.839; 0.830; 0.862 (see Table 1). Similar results, confirming the first part of the working hypothesis, which is guiding the research, and namely that there is a positive relationship between the level of digitization and the life quality, are achieved in the researches of O. Kryzhanovskij, N. Baburina and A. Ljovkina (2021), M. Tátrai and R. Szabó (2020), I., Osipova and T. Naumova (2020), L. Ionescu-Felegă, B. Ionescu and O. Stoika (2022).

What is new in this article, which until now has not been empirically verified, but has been only formulated as a hypothesis, is related to the survey on the strength and direction of the relationship between DESI and the indices included in QLI during the period 2019-2022. In this line of thought, it should be underlined that during the analyzed period strong dependences between DESI and PPI and between DESI and Cost of Living Index are established. The values of the coefficient of K. Pearson in relation to the first dependence in chronological order are

Table 1. Correlation between DESI and QLI and its components during 2019-2022

Indexes		DESI 2019	DESI 2020	DESI 2021	DESI 2022
Quality of Life Index 2019	Pearson Correlation	0.834**	0.839**	0.830**	0.862**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Purchasing Power Index 2019	Pearson Correlation	0.799**	0.854**	0.808**	0.777**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Safety Index 2019	Pearson Correlation	0.105	0.098	0.066	0.056
	Sig. (2-tailed)	0.625	0.648	0.759	0.795
Health Care Index 2019	Pearson Correlation	0.574**	0.588**	0.604**	0.628**
	Sig. (2-tailed)	0.003	0.003	0.002	0.001
Cost of Living Index 2019	Pearson Correlation	0.704**	0.707**	0.730**	0.788**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Property Price to Income Ratio 2019	Pearson Correlation	-0.412*	-0.473*	-0.586**	-0.486*
	Sig. (2-tailed)	0.045	0.020	0.003	0.016
Traffic Commute Time Index 2019	Pearson Correlation	-0.216	-0.214	-0.347	-0.287
	Sig. (2-tailed)	0.312	0.314	0.097	0.174
Pollution Index 2019	Pearson Correlation	-0.830**	-0.782**	-0.740**	-0.792**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Climate Index 2019	Pearson Correlation	-0.332	-0.326	-0.246	-0.171
	Sig. (2-tailed)	0.113	0.120	0.247	0.423

Source: Authors calculation on the grounds of DESI and QLI data; Notes: ** correlation is significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2-tailed)

as follows: 0.799; 0.854; 0.808; 0.777. The conclusion which can be drawn up is that the higher level of digitalization contributes to increase the purchasing power of the population, which reflects in improving the life quality as the reverse is also true. The scientific ethics requires to be pointed out that in 2019 a strong dependence between DESI and PPI was found by M. Tátrai and

R. Szabó (2020) for 28 EU member states. At the same time considering the second dependence the values of the correlation coefficient are: 0.704; 0.707; 0.703; 0.788 (see table 1). The direct relationship means that as the level of digitalization is increasing the prices of consumer goods are also increasing, which worsens the life quality. In other words the level of digitalization has a

negative impact on the Cost of Living Index. Objectivity requires to be mentioned that the two established dependencies to some extent are in contradiction with each other. The logical explanation for this discrepancy is related to the way accepted by NUMBEO for calculation of PPI (see above in the text). An increase in its value means that the average net salary increases and can be used for buying more goods and services. The opposite is also true. At the same time the increase in the average net salary under the influence of digitalization causes an increase in aggregate demand and an increase in the prices of goods and services, but at lower rate than the average net salary. To some extent these considerations are confirmed by the strong positive relationship between PPI and the Cost of Living Index. The values of K. Pearson's coefficient during the period 2019-2022 are statistically significant and amount respectively to 0.844, 0.830, 0.843 and 0.828 (see Table 2).

During the analyzed period two other interesting dependencies are found. The first is significant in strength in all four years of the studied period, and the second is moderate in 2019, 2020 and 2022, and significant in 2021. The first one is between DESI and the Health Care Index. The values of correlation

coefficient are increasing during the years as follow: 0.574; 0.588; 0.604; 0.628 (see Table 1). It is obvious that digitalization has a positive impact on the health system and confirms the thesis of authors as A. Barlybaev, Z. Ishnazarova and I. Sitnova (2021) and K. Ganju, P. Pavlou and R. Banker (2016). Regarding the second dependence it is between DESI and Property Price to Income Ratio. The relationship between the variables is inverse as the values of the correlation coefficient during the four years are respectively -0.412, -0.472, -0.586 and -0.486 (see table 1). In other words the increase in the level of digitalization increases the affordability of real estates for the population. The logical explanation is that digitalization contributes to the rise of the average net salary, which on its turn increases the affordability of real estates. This statement is proven by the negative relationship between PPI and Property Price to Income Ratio during the period 2019-2022 (see table 2).

A strong inverse relationship is found between DESI and the pollution index. The values of the correlation coefficient during the analyzed period 2019-2022 are as follow: -0.830; -0.782; -0.740; -0.792 (see table 1). It is obvious that the growth in the level of digitalization leads to a decrease in the level

Table 2. Correlation between PPI and Cost of Living Index and Property Price to Income Ratio during 2019-2022

Indexes		PPI 2019	PPI 2020	PPI 2021	PPI 2021
Cost of Living Index	Pearson Correlation	0.844**	0.830**	0.843**	0.828**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Property Price to Income Ratio 2019	Pearson Correlation	-0.481*	-0.536**	-0.528**	-0.553**
	Sig. (2-tailed)	0.017	0.007	0.008	0.005

Source: Authors calculation on the grounds of DESI and QLI data; **Notes:** ** correlation is significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2-tailed)

of environmental pollution. The explanation of this dependence is that as a consequence of the digitalization the possibilities for data collection increase, which intensifies the control over pollution and limits it. This thesis is shared by authors as A. Barlybaev, Z. Ishnazarova and I. Sitnova (2021). The authors also shared the opinion that digitalization contributes to reducing crime and relieving traffic in cities, which is quite logical considering the fact that cameras, sensors and artificial intelligence are used. In the current study these hypotheses are checked through two dependencies. The first is between DESI and the Safety Index, and the second is between DESI and the Traffic Commute Time Index. Despite the lack of logic the relationship between DESI and the Climate Index, as a component of QLI, is also checked. The first dependence is direct, but statistically insignificant, and the second and the third are inverse and again statistically insignificant (see Table 1).

4. Conclusion

On the grounds of the literature review and Pearson correlation analysis the following conclusions considering the studied relationships can be drawn up:

First, the relationship between DESI and QLI is strong with values of the correlation coefficient (r) during the analyzed period 2019-2022 respectively: 0.834; 0.839; 0.830; 0.862. In other words between the levels of digitalization and life quality there is a positive relationship;

Second, the relationship between DESI and PPI is strong and positive, which means that a higher level of digitalization contributes to increasing the purchasing power of the population. The reverse is also true;

Third, the relationship between DESI and the Cost of Living Index is strong and positive, which means that when the level of digitalization is increasing, the prices of consumer goods are also increasing, which worsens the life quality;

Fourth, the simultaneous increase in PPI and the Cost of Living Index has a logical explanation. It is related to the way accepted by NUMBEO for calculation of PPI. An increase in its value means that the average net salary increases and can be used for buying more goods and services. At the same time the increase in the average net salary under the influence of digitalization causes an increase in aggregate demand and an increase in the prices of goods and services, but at a lower rate than the average net salary.

Fifth, between DESI and the Health Care Index a significant direct relationship is established. The increasing, respectively the decreasing of the level of digitalization has a positive, respectively negative impact on healthcare.

Sixth, there is an inverse relationship between DESI and the Property Price to Income Ratio, i.e. with the increase in the level of digitalization the affordability of real estates for the population increases, respectively the quality of life increases. The opposite is also true. The explanation is that digitalization contributes to an increase in the average net salary, which in its turn makes real estates more affordable for the population. The last statement is confirmed by the negative values of the correlation coefficient between PPI and Property Price to Income Ratio during the period 2019-2022.

Seventh, between DESI and the Pollution Index strong inverse relationship is established. Therefore when the level of digitalization

increases, the level of environmental pollution decreases as the reverse is also true.

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