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Article

Assessing the Potential for Digital Transformation

Tatiana Corejova [1,2,*] and Roman Chinoracky [2]

1 CEE Institute, Ningbo University of Technology, Ningbo 315211, China
2 The Faculty of Operation and Economics of Transport and Communications, University of Zilina, Univerzitna 8215, 010 26 Zilina, Slovakia; roman.chinoracky@fpedas.uniza.sk
* Correspondence: tatiana.corejova@fpedas.uniza.sk

Abstract: Historically, new technologies have always increased the efficiency of production processes. Production process efficiency increases productivity. With the growth of productivity, there is usually an increase in sales and profit. Today's world is mainly influenced by digital technologies. The digitization of production processes leads to the digital transformation of the business and natural economy sectors. If, like other technologies in the past, the effects of digital technologies are associated with a growth in efficiency, productivity and thus also revenues and profits, the aim of this article is to propose a model to assess the potential of a digital transformation from a macroeconomic perspective. The proposed model, which was based on a composite indicator expressing the potential for digital transformation, was quantified for a certain period and for a selected sample of countries. The potential for digital transformation can occur in any country, regardless of the purchasing power of its population and GDP per capita. We can assume that the economic benefits of digital technologies are obvious. Businesses operating in any country innovate and are driven by digital technologies. This is also reflected in employment. New workers who know how to work with digital technologies are needed. Therefore, the results of the assessments and the proposal itself serve as a basis for national policy makers to create national strategies for digital transformation.

Keywords: digital technologies; digitization; digitalization; digital transformation; digital economy; potential of digital transformation

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1. Introduction

From the industrial revolutions of the past to the present, we have been able to witness rapid technological progress and each industrial revolution brought about extensive structural changes. Revolutionary technologies such as the steam engine and the electrification and automation of assembly lines forever changed the way we make, distribute, and sell products.

Digital technologies are the driving force behind the current industrial revolution. These technologies are experiencing rapid development. A well-known example of this is Moore's law, which states that from the 1970s to the present, the number of integrated circuits doubled about every two years [1]. This is also the case for the processing speed, memory capacity of computers and even the size of pixels in digital cameras. With the development of these technologies, their operational capabilities are increasing exponentially.

From many examples, many companies have found ways to use these technologies for their own benefit. There are many studies dedicated to measuring the effects of the use of digital technologies. These studies are mainly oriented towards the examination of effects of digital technologies on business performance from a theoretical point of view [2,3].

From a macroeconomic perspective, an OECD study, "Measuring digital transformation", concluded that many measurements of digital transformation tend to struggle with the rapid pace of development of digital technologies. Furthermore, the OECD raises a number of questions regarding the issue of digital transformation. One of these questions is how can digital transformations be measured and tracked in all sectors of the economy [4]?

After extensive research, it can be concluded that there is currently no study that tries to answer this question. In other words, there are no scientific approaches that quantify digital transformation or perspectives of digital transformation, such as its potential.

Therefore, in accordance with OECD, the aim of this article is not only to design an analytical tool that will measure digital transformation but also measure and assess the potential with which a nation uses or wastes a chance for the digital transformation of its economy.

As the impact of digital technologies on the day-to-day running of businesses is clearly visible, the importance of the research presented in this article lies in the design of a new digital transformation assessment model. According to this model, an analytical tool, it is possible to measure and assess the potential for digital transformation from a macroeconomic perspective.

For the purposes of fulfilling the set goal, it is necessary to understand the basic terminology and the methodology that we used when we created the presented model to measure and assess the potential for digital transformation.

Literature Review

Digital technologies have changed the way businesses conduct their day-to-day operations. Businesses need to make significant efforts to respond to these changes. Most of the challenges and opportunities for individual companies as well as entire industries and society lie in changes related to people, processes, strategies, structures and the dynamics of competition. Digital technologies also lead to faster innovation, higher productivity, greater process efficiency, and an improved customer experience. Changes require a clear recognition of the need to transform, an understanding of what needs to change, and a plan for making the desired changes.

Digital technologies include any device or application that processes information in the form of binary codes [5]. Devices we are referring to can be physically grasped: hardware, mobile devices, and telecommunication devices (modem, router, server, etc.). On the contrary, applications are intangible and virtual: software and electronic communication networks [6–8].

The introduction of digital technologies into production processes transforms analogue information chains into digital ones. If a part of the production process is transformed, then it is being digitized and undergoes so-called digitization [9–11]. For example, in marketing, a company would not distribute classic (paper) promotional leaflets to customers but would instead use one of the online marketing tools [12–15]. If a company digitizes its whole promotion process by switching from physical promotional tools to virtual online marketing and communication tools, then we are looking at an example of the concept of digitalization [16].

Digitalization in the corporate sphere takes place in three phases. In the first phase, the individual activities of the selected process are automated. In the second phase, related activities are automated and merged to eliminate all unnecessary tasks. In the third and most complex phase, the systems of business processes and information flows are integrated into one corporate information system, which can be represented by enterprise resource planning software or other digital technology [17,18].

If a company implements several digitization projects, a digital transformation of the company occurs [19].

Digital transformation takes place across companies, industries, and society. Business models and corporate culture are changing, and from a traditional enterprise it becomes either a digital enterprise or a company that uses digital technologies with high intensity, in almost all phases of its business activity [20,21]. As a result of digital transformation, businesses and entire economies are more interconnected. The interconnections of economies and enterprises contribute to the creation of a more globalized world economy [22].

If businesses are digitally transformed, entire business sectors and the state economies change. In scientific publications, in connection with the digital transformation of the economy, we encounter the term digital economy [23–25].

A digital economy, according to its tiered definition, at its core, consists of the outputs of the economic activity of producers of digital content, goods, and the information and communication technology (ICT) services. Outputs created by the businesses forming the core of digital economy changed the business models and value chains of all institutions [26,27].

A narrower definition of the digital economy assigns to its core the outputs of economic activity of companies, which are dependent on digital inputs. The broader definition of the digital economy assigns to its previous two levels the economic activity of companies, which is strongly supported by digital inputs. The outputs of companies that make up the digital economy, in its narrower and broader sense, are non-digital technologies or products [27–29].

If we know that changes are taking place not only at the level of businesses, but at the level of the whole economy and digital technologies are therefore everywhere, we can ask ourselves the question: what are the impacts of digital technologies on businesses, economies and society?

Technologies generally increase the efficiency of production processes. If a car manufacturer automates and digitizes the production process using robots, the production of a single car is more efficient and faster by eliminating the error associated with human work. In addition, by digitizing the manufacturing process, the car manufacturer gains plenty of information to make more informed managerial decisions through better material delivery planning [30,31].

The increase in efficiency can also be reflected in the provision of digital products, which with their simplified functionality replace traditional services. An example is filing an electronic tax return, where citizens of the state can file a tax return with a few clicks on the Internet and the tax administration's website without having to visit the tax office in person. The elimination of paper forms and automation of the registration of some tax documents creates space for faster, more accurate and more efficient collection of taxes and tax data of taxpayers [32]. Another example is electronic prescriptions of medicine. Shorter waiting times and a reduction in the number of patients waiting, caused by the elimination of unnecessary tasks, leads to having more space and time that a doctor can devote to the patient, and thus the quality of health care can be improved [33,34].

Therefore, if we say that processes are being simplified and work efficiency is increasing, it can be expected that there will be room for growth in labour productivity [35].

A more productive company can produce a product faster or provide a service that can be delivered to a customer in a shorter time. If the product is produced faster or the service is provided in a shorter time frame, there is room for a decrease in operating costs. These may be labour costs and costs associated with the operation of buildings and equipment [36].

This means that the growth of labour productivity is also associated with the growth of sales. Although the cost of acquiring and operating various digital technologies can be high, with revenue growth, a business, after achieving a full return on investment or after a reduction in operating costs, can be profitable over time [37].

The further impacts of digital technologies and digital transformation can be seen in the labour market [38]. This impact can be understood from two perspectives.

The first perspective points to the destructive effect of digital technologies. The digitization and automation of production processes means that some jobs become redundant. An example is any job position that is based on routine work—from administrative assistants and workers to various assembly workers and stock keepers [39].

The second perspective highlights the capitalization effect as a catalyst for job creation. The demand for new jobs can grow from the introduction of new digital technologies into various business processes. If a company starts using information systems to manage business resources, then it is very likely that it will need an employee (by direct employment or by hiring them from another company) who will deal with the operation and service of the system. The new jobs created by the digital transformation are in many cases dependent on a highly skilled workforce that does this work for a relatively high wage. As wages rise, so does the purchasing power and quality of life of the population [39,40].

Now that we know the impact of digital technologies, we can ask ourselves further questions that relate to this topic: When will the digital transformation take place? How can the potential for digital transformation be assessed or measured? What indicators can be used to assess the potential of digital transformation of the economy? What dimensions need to be evaluated?

2. Materials and Methods

In economics, the performance of economic subjects is quantified using specific indicators. An indicator expresses a certain characteristic of economic activity. This characteristic can be any information (most often in the form of a number) that describes or quantifies a certain economic phenomenon [41].

One such phenomenon, which is the subject of our interest, is digital transformation. Several expert studies have addressed the question of which indicators should be assessed and measured when examining digital transformation (or digitalization and digital economy). A comprehensive framework, compiling the findings of these studies, was issued at the G20 meeting as part of the Toolkit for measuring the Digital Economy study [42]. The OECD supplemented this study with its own findings and published them in its own publication, A roadmap towards a common framework for measuring the Digital Economy, where it points out that the demand for new tools and measurements resulting from the growing role of digital technologies in the world economies is acute [43].

In the light of this conclusion, the OECD has developed a framework of individual indicators for measuring the impact of digital technologies on businesses, economies, and society. According to the OECD, individual indicators are categorized into three groups (or dimensions) [43]:

- The first group of individual indicators focuses on the economy and consists of indicators that examine the economic performance of economic entities falling within the definition of the digital economy.
- The second group of individual indicators focuses on examining the impact of digital technologies on labour and jobs.
- The third group of individual indicators includes indicators according to which it is possible to examine the impact of digital technologies on work skills.

If we want to examine the potential of digital technologies, it is necessary to consider that the potential can be assessed by examining how the values of either individual or composite indicators change dynamically over time. The OECD framework of individual indicators for measuring the impact of digital technologies on businesses, economies and society has formed the basis for our assessments as well as measurements for quantifying the potential for digital transformation. Only those individual indicators for which data are available for selected countries (EU and OECD members) and for a selected period (2008–2018) were included in the final calculations. A list of the individual indicators used in the calculations are stated in Appendix A (Table A1).

Digitalization, digital transformation, and the digital economy are complex phenomena. Their complexity lies in the fact that it is possible to look at them from different angles. Therefore, these phenomena cannot be assessed only by individual indicators, but by composite indicators. There are more than 20 of them and according to their thematic focus they mostly examine: the level of electronic services of the state, the level of digital skills, the intensity of the use of digital technologies and the telecommunications infrastructure [44–46].

Given the nature of digitalization, digital transformation, and the digital economy as complex phenomena, it is possible to quantify the potential for digital transformation using a composite indicator. The proposed composite indicator will, on the one hand, copy existing composite indicators and, on the other hand, complement them by expressing what these indicators do not examine.

The proposed composite indicator contains new dimensions, derived from the groups of individual indicators presented in the previously mentioned OECD study [38]. These new dimensions are aimed at examining the impact of the digital transformation on the economy, skills, and labour. The name of the proposed composite indicator is the Digital Transformation Potential Index (DTPI). DTPI quantifies the potential for digital transformation to occur in each country.

The index is composed of the modified individual indicators listed in Appendix A (Table A1). The modification occurred because if we want to examine potential, we had to look at the year-to-year changes of values of selected individual indicators. The list of modified individual indicators, which also represent the structure of DTPI, is listed in Appendix B (Table A2). The individual indicators are grouped into three dimensions—economy, labour, and skills. If the annual values of individual indicators increase or decrease, there is a greater or lesser potential for the digital transformation of the economy, work, and skills of state workforce.

For example, if the added value generated by the ICT sector and high-digital-intensity industries grow annually through the output of their work, which is largely influenced by digital technologies, there is potential for GDP growth to which digital technologies contributed. As investment in ICT grows annually, there is potential for digitization and the digitalization of business processes through the introduction of new technologies into business processes, which can lead to a gradual digital transformation of businesses. If the import and export of ICT products grows on year-on-year basis, there is a growth of the potential for the transformation of foreign trade, which becomes more dependent on digital technologies.

As employment grows annually in the ICT sector and in high-digital-intensity industries, the digital transformation of these industries may deepen, with new technologies forcing companies to hire new employees or substituting them to increase the efficiency of business processes. There may also be a situation where employment in the ICT sector and high-digital-intensive industries will grow to such extent that it will be possible to talk about the transformation of the labour market caused by the digital transformation. If labour productivity is growing in the ICT sector and high-digital-intensity industries, the growth is most likely due to digital technologies, as the outputs generated by these companies are largely influenced by these technologies. As in the case of employment, changes in labour productivity in the ICT sector and in high-intensity digital industries can have a significant impact on the overall labour productivity in the country. In other words, there may be changes in labour productivity caused by digital technologies.

As the number of ICT specialists in businesses and the demand for ICT specialists grows on a year-on-year basis, the digital transformation of businesses might be occurring, as businesses need specialists who will be able to work with the digital technologies that have transformed their business activities. If the number of ICT specialists who enter the labour market after completing specific university study programs grows annually, there is room for the creation of new companies and new jobs that may be directly dependent on digital technologies.

Knowing the logic and structure of the index, we performed a calculation of its individual indicators. Data entering the calculations of the DTPI were obtained from the databases OECD STAN, OECD National Accounts, OECD Information and Communication Technology, OECD Education and Training, UNCTAD Statistics, Eurostat Digital Economy and Society, Eurostat Education and Training [47–56].

In the calculations of individual indicators, in many cases, a situation occurred where data were not available for a selected country and a certain year. We supplemented the missing data by two methods. The first method we used was linear regression, where the values of individual indicators were estimated and predicted. The method substituted the missing values of the individual indicators with the values of the equivalent individual indicators.

We perceived all dimensions of the DTPI as equivalent. This means that each value of the individual indicator was converted using a specific weight. The weight of each dimension (w) represents a third of the total—33.33%. Each dimension is made up of several individual indicators (x_i). The ratio (w_I) of the weight of a dimension to the number of individual indicators expresses the weight of the individual indicator of each dimension (Table 1).

Table 1. Calculation of weights.

Dimension	w	x_i	w_I
Economy	$w_E = 33.33\%$	4	$w_{I_E} = 8.333\%$
Labour	$w_L = 33.33\%$	4	$w_{I_L} = 8.333\%$
Skills	$w_S = 33.33\%$	9	$w_{I_S} = 3.704\%$

The values of individual indicators $I^t_{q,c}$ for country c at time t and the weights of the individual indicators w_I of each dimension are the sums of their arithmetic averages aggregated into the final value of the $DTPI^t_c$ for country c at time t:

$$DTPI^t_c = \frac{1}{n}\sum_{i=1}^{n} I^t_{q,ciE} * w_{I_E} + \frac{1}{n}\sum_{i=1}^{n} I^t_{q,ciL} * w_{I_L} + \frac{1}{n}\sum_{i=1}^{n} I^t_{q,ciS} * w_{I_S}$$

Individual indicators $I^t_{q,c}$ for country c at time t of $DTPI^t_c$ are annual values and are expressed using a simple individual chain index, where the indicator q is an extensive quantity expressed in absolute numbers at a specific time $t_0, t_1, \ldots, t_T$:

$$I^t_{q,c} = \frac{q_t}{q_{t-1}}$$

The higher the value of the DTPI, the higher the potential for digital transformation in the selected country. The potential for digital transformation may occur in a given country in the following time periods after the year in which the positive potential was measured. If the value of the DTPI is negative or zero, then the potential for digital transformation is not present.

3. Results

The values in Tables 2–5 are graphically differentiated to highlight those values for the selected country and year in which there was a greater or lesser potential for digital transformation. In essence, the interpretation of the resulting DTPI assessments defined in this way is a heat map that by a specific set of colours visually summarizes the obtained information. A dark green colour represents large to medium-large potential for the digital transformation that may have occurred in each period and country. Lighter shades of green represent medium-low to low potential for digital transformation. Negative values and zero values express zero potential and the absence of potential for digital transformation.

According to assessments (Table 2), in Denmark, Luxembourg, Hungary and Germany, the potential for digital transformation occurred in each of the monitored time periods. From the opposite point of view, the same situation did not occur. In none of the countries was there a situation where the potential for digital transformation would not occur during the entire ten-year period. The longest zero potential for digital transformation occurred in four periods within the examined time frame. This is the case for countries such as Italy, Lithuania, and Poland, with three consecutive periods in Italy.

Table 2. Assessed values of DTPI.

State/Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Belgium	0.50%	1.06%	0.00%	0.24%	0.86%	0.24%	−0.01%	1.77%	0.08%	0.25%
Czech Republic	0.48%	0.34%	0.00%	0.27%	−0.07%	0.16%	0.13%	0.00%	0.08%	0.29%
Denmark	0.15%	0.40%	0.21%	0.22%	0.19%	0.20%	0.33%	0.46%	0.07%	0.02%
Estonia	−0.62%	1.33%	0.62%	0.21%	0.79%	−0.10%	0.29%	0.59%	0.09%	−0.04%
Finland	−0.67%	0.13%	−0.03%	0.04%	0.59%	0.30%	0.27%	0.16%	0.05%	0.30%
France	0.03%	0.31%	−0.07%	0.18%	0.49%	0.11%	0.37%	0.06%	0.24%	0.03%
Netherlands	0.32%	0.30%	0.24%	0.41%	−0.14%	0.22%	0.54%	0.30%	0.04%	0.21%
Latvia	0.02%	−0.16%	1.19%	0.38%	0.37%	0.41%	0.24%	−0.30%	−0.34%	0.18%
Lithuania	−0.50%	0.54%	−0.05%	0.13%	0.59%	0.06%	0.32%	−0.06%	0.81%	−0.16%
Luxembourg	1.19%	0.86%	1.52%	1.89%	0.04%	0.40%	0.37%	0.67%	0.29%	0.44%
Hungary	1.03%	0.57%	3.05%	0.33%	0.61%	0.13%	0.08%	0.36%	0.15%	0.36%
Germany	0.03%	0.73%	0.30%	0.35%	0.75%	0.28%	0.31%	0.05%	0.11%	0.04%
Poland	1.80%	0.32%	−0.05%	0.40%	−0.08%	−0.02%	1.84%	−0.12%	0.15%	0.05%
Portugal	−0.33%	0.06%	0.14%	0.10%	−0.04%	0.10%	0.15%	0.25%	0.08%	0.22%
Austria	−0.39%	0.90%	0.29%	0.55%	−0.03%	−0.30%	1.34%	0.18%	0.33%	0.23%
Slovakia	0.70%	0.71%	−0.67%	0.02%	−0.07%	0.22%	0.31%	−0.11%	0.14%	−0.33%
Slovenia	0.40%	0.85%	0.07%	1.25%	3.46%	0.16%	0.19%	2.00%	−0.82%	0.30%
Spain	0.15%	0.68%	0.10%	−0.25%	1.47%	0.32%	0.34%	0.12%	0.28%	0.00%
Italy	0.28%	0.41%	−0.04%	−0.14%	−0.04%	0.02%	1.97%	−0.18%	0.04%	0.19%

Table 3. Share of individual indicators of the economy dimension on DTPI.

State/Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Belgium	−0.02%	0.01%	−0.04%	−0.05%	−0.10%	0.09%	0.11%	0.03%	0.01%	−0.04%
Czech Republic	0.03%	0.16%	−0.02%	−0.08%	−0.07%	0.08%	0.21%	−0.08%	0.02%	0.16%
Denmark	−0.02%	0.08%	0.05%	0.04%	−0.06%	0.03%	0.14%	0.03%	0.04%	−0.04%
Estonia	−0.38%	0.89%	0.39%	0.08%	0.09%	0.09%	0.00%	0.06%	−0.24%	0.09%
Finland	−0.37%	−0.32%	−0.11%	−0.12%	−0.33%	0.16%	0.11%	0.13%	0.07%	0.10%
France	−0.06%	0.11%	−0.05%	−0.01%	−0.06%	0.03%	0.13%	0.02%	0.05%	−0.02%
Netherlands	0.06%	0.04%	−0.03%	−0.06%	−0.01%	0.05%	0.08%	0.15%	−0.14%	0.01%
Latvia	−0.23%	0.01%	0.20%	0.19%	0.28%	0.54%	0.14%	0.00%	−0.12%	0.08%
Lithuania	−0.36%	0.23%	−0.02%	−0.01%	0.01%	0.14%	0.40%	0.11%	0.19%	−0.05%
Luxembourg	0.16%	−0.03%	−0.01%	0.05%	−0.10%	0.11%	0.14%	0.07%	0.04%	0.01%
Hungary	0.05%	0.04%	−0.15%	−0.09%	0.00%	−0.14%	0.13%	−0.02%	0.20%	0.15%
Germany	−0.09%	0.12%	−0.09%	−0.04%	−0.04%	0.10%	0.13%	0.03%	0.08%	0.00%
Poland	0.23%	0.04%	−0.14%	0.07%	0.04%	0.18%	0.17%	−0.09%	0.07%	0.04%
Portugal	−0.37%	−0.11%	−0.15%	−0.16%	−0.16%	−0.03%	0.12%	0.19%	0.09%	0.00%
Austria	−0.10%	0.04%	−0.04%	0.06%	0.03%	−0.01%	0.12%	−0.02%	−0.01%	0.03%
Slovakia	0.04%	0.02%	−0.30%	−0.05%	−0.07%	0.24%	0.23%	−0.14%	0.44%	−0.24%
Slovenia	−0.09%	−0.02%	−0.10%	−0.19%	−0.10%	0.12%	0.22%	−0.05%	0.11%	−0.01%
Spain	−0.23%	0.02%	−0.30%	−0.17%	−0.11%	0.08%	0.16%	0.07%	0.13%	0.09%
Italy	0.01%	0.27%	−0.09%	−0.16%	−0.09%	−0.02%	0.18%	0.01%	0.06%	0.00%

Table 4. Share of individual indicators of the labour dimension on DTPI.

State/Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Belgium	0.07%	0.11%	0.01%	0.19%	−0.10%	0.05%	0.15%	−0.03%	0.21%	0.04%
Czech Republic	0.11%	0.11%	−0.02%	0.22%	−0.08%	0.15%	0.04%	0.12%	0.07%	0.18%
Denmark	0.01%	0.04%	−0.03%	0.08%	0.03%	0.04%	0.02%	0.07%	0.06%	0.03%
Estonia	−0.03%	0.10%	0.00%	0.14%	0.05%	−0.04%	0.06%	0.38%	0.33%	−0.19%
Finland	−0.05%	0.04%	0.01%	0.19%	−0.15%	0.10%	0.02%	0.01%	0.11%	0.10%
France	0.06%	0.08%	−0.11%	0.17%	−0.05%	0.08%	0.14%	0.05%	0.12%	0.03%
Netherlands	0.19%	0.17%	0.20%	0.21%	−0.05%	0.10%	0.10%	0.05%	0.21%	0.06%
Latvia	−0.19%	−0.01%	0.02%	0.06%	−0.07%	0.13%	0.00%	−0.04%	−0.01%	0.16%
Lithuania	−0.10%	0.00%	0.01%	0.12%	−0.08%	0.08%	0.06%	0.07%	0.30%	−0.01%
Luxembourg	−0.01%	0.06%	0.00%	0.23%	−0.16%	0.09%	0.09%	0.13%	0.04%	0.05%
Hungary	−0.02%	0.04%	−0.15%	0.00%	0.25%	0.08%	−0.05%	0.05%	0.08%	0.06%
Germany	−0.01%	0.08%	−0.08%	0.12%	0.00%	0.07%	0.04%	0.02%	−0.01%	0.08%
Poland	0.06%	−0.03%	−0.08%	0.18%	−0.13%	0.01%	0.07%	0.07%	0.06%	0.12%
Portugal	0.03%	0.04%	−0.13%	0.00%	0.09%	0.16%	0.04%	0.05%	−0.05%	0.15%
Austria	0.01%	0.00%	0.07%	0.03%	0.01%	−0.01%	0.09%	0.06%	0.10%	−0.05%
Slovakia	−0.03%	0.10%	−0.13%	0.05%	−0.06%	0.01%	0.13%	0.15%	−0.08%	0.03%
Slovenia	0.03%	0.06%	0.01%	0.00%	−0.01%	0.11%	−0.01%	0.04%	0.09%	0.17%
Spain	0.05%	0.02%	−0.03%	−0.16%	0.45%	−0.01%	0.08%	0.09%	−0.04%	0.06%
Italy	0.09%	0.10%	0.06%	0.07%	0.06%	0.04%	0.08%	0.09%	0.04%	0.07%

Table 5. Share of individual indicators of the skills dimension on DTPI.

State/Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Belgium	0.44%	0.95%	0.04%	0.09%	1.05%	0.10%	−0.27%	1.77%	−0.15%	0.24%
Czech Republic	0.33%	0.07%	0.05%	0.12%	0.08%	−0.07%	−0.12%	−0.04%	−0.02%	−0.05%
Denmark	0.16%	0.28%	0.19%	0.10%	0.21%	0.13%	0.17%	0.36%	−0.03%	0.02%
Estonia	−0.21%	0.33%	0.24%	0.00%	0.64%	−0.15%	0.23%	0.15%	0.01%	0.06%
Finland	−0.25%	0.41%	0.06%	−0.04%	1.06%	0.04%	0.14%	0.02%	−0.13%	0.10%
France	0.02%	0.12%	0.09%	0.03%	0.60%	0.00%	0.09%	−0.02%	0.07%	0.02%
Netherlands	0.07%	0.09%	0.07%	0.26%	−0.08%	0.08%	0.36%	0.10%	−0.02%	0.14%
Latvia	0.44%	−0.16%	0.97%	0.14%	0.16%	−0.26%	0.10%	−0.25%	−0.21%	−0.05%
Lithuania	−0.04%	0.32%	−0.04%	0.02%	0.67%	−0.15%	−0.14%	−0.24%	0.31%	−0.10%
Luxembourg	1.04%	0.84%	1.53%	1.61%	0.30%	0.20%	0.14%	0.48%	0.21%	0.38%
Hungary	1.01%	0.49%	3.35%	0.41%	0.35%	0.18%	0.00%	0.32%	−0.13%	0.15%
Germany	0.12%	0.53%	0.46%	0.27%	0.78%	0.10%	0.14%	0.00%	0.03%	−0.04%
Poland	1.51%	0.31%	0.17%	0.15%	0.01%	−0.20%	1.60%	−0.10%	0.02%	−0.12%
Portugal	0.01%	0.13%	0.42%	0.26%	0.03%	−0.03%	−0.01%	0.01%	0.04%	0.08%
Austria	0.39%	0.30%	0.14%	0.18%	0.31%	0.08%	−0.03%	0.11%	−0.03%	0.08%
Slovakia	0.68%	0.60%	−0.24%	0.02%	0.06%	−0.03%	−0.05%	−0.11%	−0.22%	−0.13%
Slovenia	0.46%	0.82%	0.16%	1.44%	3.56%	−0.08%	−0.02%	2.01%	−1.01%	0.15%
Spain	0.33%	0.65%	0.42%	0.09%	1.13%	0.25%	0.11%	−0.04%	0.19%	−0.16%
Italy	0.17%	0.04%	−0.01%	−0.05%	−0.01%	−0.01%	1.71%	−0.28%	−0.05%	0.12%

In Hungary, at the turn of 2010/2011, and in Slovenia, at the turn of 2012/2013, a high potential for digital transformation was observed. Medium potential for digital transformation occurred in Poland (2008/2009—2014/2015), Luxembourg (2011/2012), Italy (2014/2015), Belgium and Slovenia (both 2015/2016). For the rest pf the time periods and countries, there was predominantly moderately low potential for digital transformation.

The time periods of 2014/2015 and 2009/2010were the most favourable for a digital transformation. In both cases, there was a situation where only one of the countries did not produce the potential for digital transformation (2014/2015—Belgium; 2009/2010—Latvia).

Most countries (eight) had zero potential for digital transformation in 2010/2011. During this period, we can assume that the potential that arose in the previous period (2009/2010) was exhausted. The potential for digital transformation received a certain incentive at the turn of 2011/2012, where only two countries did not have the potential for digital transformation. This potential was assumingly exhausted and the second largest number of countries (seven) with zero potential for digital transformation was recorded in 2012/2013.

Table 2 provides us with information on the extent to which the potential for digital transformation was created. Tables 3–5 provide us with information about the potential for the digital transformation of the economy, labour demand and labour supply.

In 2009/2010, only seven countries had the potential to digitally transform their economies (see Table 3). This period is associated with the Subprime mortgage crisis, the negative impact of which was reflected not only in national economies, but also in the performance of digital economies. A year later, digital economies sort of recovered and the potential for digital transformation of national economies re-emerged. In Estonia, this year even assessed the highest potential for the digital transformation of Estonia's economy among all the countries and time periods.

At the turn of 2010 and 2011, a new crisis, this time the Eurozone crisis (or the European debt crisis), caused a recession not only in the economies of the selected countries but also a recession of their digital economies. In 2010/2011, the potential for digital transformation of economies emerged in only three countries. This trend continued and in 2011/2012 there were six states and in 2012/2016 five states with potential for digital transformation of their economies. In the following years, there was some recovery and at the turn of 2014 and 2015, except for Estonia, the potential for digital transformation of its economy emerged in each country.

The potential for the digital transformation of employment and labour demand, as in the previous case, was absent in the periods 2008/2009, 2010/2011 and 2012/2013 (see Table 4). During these years, the potential of digital technologies was in some countries exhausted and did not receive any incentive to revive itself. The change occurred at the turn of 2013/2014. Since then, the potential for digital transformation of employment and labour demand emerged in every year and in almost every country.

In Italy, there was potential for the digital transformation of jobs in each of the examined periods. In Denmark and the Netherlands, potential was also present in almost all examined time periods. It can be assumed that digital technologies in these countries have long played an important role in the performance of various jobs. The country with the least potential for digital transformation of labour is Latvia. This, in turn, can mean that digital technologies do not affect the performance of various jobs in the long run.

If we look at the dimension of skills (see Table 5), an annual increase in the number of university graduates was found from turn of years 2008/2009 to 2012/2013. After 2012/2013, there was a certain stagnation and, in many countries, there was no potential for digital transformation, which would be carried out by university graduates. The situation is the opposite for the dimensions of the economy and labour.

It can be assumed that, for demographic reasons, the number of university students decreased in many countries, which is reflected in the number of graduates.

Where there was not a long-term annual increase in the number of university graduates, who are fit from their education to work as ICT specialists, it can be assumed that there is a shortage of ICT specialists. This situation, according to assessments, occurred in the Czech Republic, Slovakia, and Latvia. Conversely, where there is a sufficient year-on-year growth of number of graduates, the future ICT specialists, there is a sufficient workforce that can be a driving force for the changes associated with digital technologies. In this case, these situations occurred in countries such as Luxembourg, Denmark, Germany, and France.

If we look at the assessments of the DTPI from the point of view of averages (Table 6), over the examined time periods, on average, most of the potential for digital transformation occurred in Slovenia, Luxembourg, and Hungary. In these countries, the greatest potential for digital transformation was generated by university graduates who, by studying specific study programs, are predisposed to perform the work of ICT specialists.

Table 6. Share of individual indicators of the skills dimension on DTPI.

State	E	L	S	Total Average
Slovenia	−0.01%	0.05%	0.75%	0.79%
Luxembourg	0.04%	0.05%	0.67%	0.77%
Hungary	0.02%	0.03%	0.61%	0.67%
Belgium	0.001%	0.07%	0.43%	0.50%
Poland	0.06%	0.03%	0.33%	0.43%
Estonia	0.11%	0.08%	0.13%	0.32%
Spain	−0.03%	0.05%	0.29%	0.32%
Germany	0.02%	0.03%	0.24%	0.29%
Italy	0.02%	0.07%	0.16%	0.25%
Netherlands	0.01%	0.12%	0.11%	0.24%
Denmark	0.03%	0.04%	0.16%	0.22%
Latvia	0.11%	0.004%	0.09%	0.20%
Austria	0.01%	0.03%	0.15%	0.19%
France	0.01%	0.06%	0.10%	0.17%
Czech Republic	0.04%	0.09%	0.04%	0.17%
Lithuania	0.06%	0.05%	0.06%	0.17%
Finland	−0.07%	0.04%	0.14%	0.11%
Slovakia	0.02%	0.02%	0.06%	0.09%
Portugal	−0.06%	0.04%	0.09%	0.07%

In general, this applies to almost every country. The exceptions are the Netherlands and Latvia. In the Netherlands, the labour market produces the potential for digital transformation, and in Latvia it is the state's digital economy. This means that it is possible to assume that the driving force of the digital transformation is mainly education, which is represented by university graduates.

The least potential for digital transformation was found in Finland, Slovakia, and Portugal. In the case of these countries, it can be said that this is a missed opportunity for the development and growth associated with digital technologies.

The size of the country and its economic strength, represented by the indicator of GDP per capita, which determines the purchasing power of the population, create a presumption based on which we can assume that modern digital technologies are used mainly in economically strong countries. The opposite is true (see Table 7). In each year, the ranking of countries changed significantly according to the value of the DTPI. In some cases, significant change of order occurred.

Table 7. Ranking of countries sorted according to the values of the DTPI.

State/Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Poland	1	18	3	2	7	14	9	7	17	2
Luxembourg	2	5	2	7	11	2	1	5	16	3
Hungary	3	16	14	16	5	11	16	2	2	7
Slovakia	4	2	18	8	18	19	8	18	11	19
Belgium	5	7	12	1	12	12	13	10	13	6
Czech Republic	6	12	16	14	3	5	2	3	3	5
Slovenia	7	4	8	12	17	4	11	8	1	16
Netherlands	8	11	10	3	19	8	10	15	4	15
Italy	9	3	15	6	13	10	17	16	12	8
Denmark	10	17	11	5	14	6	4	19	18	9
Spain	11	9	7	10	10	7	12	11	15	14
Germany	12	10	5	18	2	3	18	13	6	1
France	13	6	6	13	16	13	19	12	5	12
Latvia	14	1	19	17	9	15	14	6	10	13
Portugal	15	13	9	15	15	17	7	17	19	10
Austria	16	8	1	19	4	9	15	4	9	11
Lithuania	17	19	17	4	6	1	6	1	8	18
Estonia	18	15	13	9	1	18	3	9	14	17
Finland	19	14	4	11	8	16	5	14	7	4

For example: the largest decrease was observed in Poland in 2008/2009 and in Estonia in 2012/2013. Both countries were in first place and the highest potential for digital transformation was measured. In the following period, Poland and Estonia were 18th (out of 19 countries).

On the contrary, the largest growth occurred in Germany and Luxembourg. In the period 2011/2012, Germany was at the penultimate position of the ranking (18th). Luxembourg was in 16th place in 2016/2017. Both countries' positions changed significantly in the following year. Germany was in second place, with Luxembourg in third.

This means that the potential for digital transformation can occur in any country, regardless of the purchasing power of its population and GDP per capita. We can assume that the economic benefits of digital technologies are obvious. Businesses operating in any country innovate and are driven by digital technologies. This is also reflected in employment. New workers who know how to work with digital technologies are needed.

4. Discussion

Digital transformation is a phenomenon that can occur in countries with different economic backgrounds. According to our assessments and measurements, the bearers of the potential for digital transformation were mainly university graduates. The potential for digital transformation, as we propose to be measured, is also affected by economic cycles. If the economy is in crisis, the potential for digital transformation is declining. As the economy grows, so does the potential for digital transformation. In connection with the findings presented in this article, the topic of discussion is the search for possibilities to expand the list of individual indicators and dimensions forming the DTPI.

Digital transformation will be a subject of growing interest. As in the past and today, scientific, and technical progress is a source of many advantages but also disadvantages.

Considering the advantages, digital transformation represents a certain opportunity to change the country's economy. This change is associated with a higher efficiency of business processes, which leads to productivity growth. Growth in productivity and efficiency can be associated with growth in sales and profits, which can also be associated with growth of living standards.

However, it is questionable whether corporate productivity (from a microeconomic perspective) will grow and lead to revenue and profit growth. The same applies to the growth of living standards from a macroeconomic point of view. Therefore, the phenomenon of digital transformation requires further in-depth research that will provide answers to many questions related to this issue.

The topic of further discussion (and thus further research) should be the practical application of specific activities related to the use of the potential brought by digital transformation. This means that the research question that needs to be answered should have the following form: what activities, policies or strategies need to be implemented at national and international levels to ensure continuous potential for digital transformation?

With the research question formulated in this way, the following questions need to be answered:

- What support activities need to be implemented to develop the use of digital technologies in the business sphere?
- What support activities need to be implemented to ensure the growth of investment in ICT and the development of the digital skills of the workforce?
- What strategy needs to be put in place for the school system to produce a more highly skilled workforce ready for practice and for the intensive use of digital technologies?
- What is the effectiveness of new and implemented activities, policies, and strategies in the use of digital technologies, or in areas related to digitalization, digital transformation, and digital economy?

The OECD provided some answers to these questions in its study Going Digital: Shaping Policies, Improving Lives, where an integrated policy framework was created [57]. Although an integrated policy framework exists, each country must approach the answers to these research questions separately according to the specific conditions in which it finds itself.

Given that new digital technologies are constantly evolving, it is necessary to open a discussion and answer questions on the topic of assessing or measuring the negative impacts associated with the digital transformation:

- How many businesses have disappeared due to digital transformation?
- How many jobs have been lost due to the digital transformation of businesses?
- Which skills are becoming redundant for the needs of the labour market affected by the digital transformation?

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Appendix A

Table A1. List of the individual indicators used for calculations.

Dimension	Name of the Individual Indicator
Economy	• Share of value added of the ICT sector and high digital-intensity industries on GDP (%) • Share of ICT investment on GDP (%) • Share of imports of ICT products on total imports (%) • Share of exports of ICT products on total exports (%)
Labour	• Share of employment in ICT sectors and high digital intensity industries in total employment (%) • Labour productivity in the ICT sector and the high digital intensity industries (millions of EUR) • Share of employees performing ICT specialist work in total employment (%) • Share of companies looking for ICT specialists on the total number of companies (%)
Skills	• Share of graduates with bachelor's degree of natural sciences, mathematics, and statistics to the total number graduates with bachelor's degree of all university study programs (%) • Share of graduates with master's degree of natural sciences, mathematics, and statistics to the total number of graduates with master's degree of all university study programs (%) • Share of graduates with doctoral degree of natural sciences, mathematics, and statistics to the total number of graduates with doctoral degree of all university study programs (%) • Share of graduates with bachelor's degree of information and communication technologies to the total number of graduates with bachelor's degree of all university study programs (%) • Share of graduates with master's degree of information and communication technologies to the total number of graduates with master's degree of all university study programs (%) • Share of graduates with doctoral degree of information and communication technologies to the total number of graduates with doctoral degree of all university study programs (%) • Share of graduates with bachelor's degree of engineering, manufacturing, and construction to the total number of graduates with bachelor's degree of all university study programs (%) • Share of graduates with master's degree of engineering, manufacturing, and construction to the total number of graduates with master's degree of all university study programs (%) • Share of graduates with doctoral degree of engineering, manufacturing, and construction to the total number of graduates with doctoral degree of all university study programs (%)

Appendix B

Table A2. List of modified indicators and structure of DTPI.

Dimension	Name of the Individual Indicator
Economy	• Year-on-year change in the value added of the ICT sector and high digital-intensity industries on GDP (%) • Year-on-year change in the value of ICT investment on GDP (%) • Year-on-year change in the value of the share of imports of ICT products on total imports (%) • Year-on-year change in the value of the share of exports of ICT products on total exports (%)
Labour	• Year-on-year change in the value of labour productivity in the ICT and high digital-intensity industries (%) • Year-on-year change in the value of employment in the ICT sector and high digital-intensity industries to total employment (%) • Year-on-year change in the value of the share of employees performing ICT specialist work in total employment (%) • Year-on-year change in the value of the share of companies looking for ICT specialists in the total number of companies (%)

Table A2. *Cont.*

Dimension	Name of the Individual Indicator
Skills	• Year-on-year change of number of graduates with bachelor's degree of natural sciences, mathematics, and statistics to the total number graduates with bachelor's degree of all university study programs (%) • Year-on-year change of number of graduates with master's degree of natural sciences, mathematics, and statistics to the total number of graduates with master's degree of all university study programs (%) • Year-on-year change of number of graduates with doctoral degree of natural sciences, mathematics, and statistics to the total number of graduates with doctoral degree of all university study programs (%) • Year-on-year change of number of graduates with bachelor's degree of information and communication technologies to the total number of graduates with bachelor's degree of all university study programs (%) • Year-on-year change of number of graduates with master's degree of information and communication technologies to the total number of graduates with master's degree of all university study programs (%) • Year-on-year change of number of graduates with doctoral degree of information and communication technologies to the total number of graduates with doctoral degree of all university study programs (%) • Year-on-year change of number of graduates with bachelor's degree of engineering, manufacturing, and construction to the total number of graduates with bachelor's degree of all university study programs (%) • Year-on-year change of number of graduates with master's degree of engineering, manufacturing, and construction to the total number of graduates with master's degree of all university study programs (%) • Year-on-year change of number of graduates with doctoral degree of engineering, manufacturing, and construction to the total number of graduates with doctoral degree of all university study programs (%)

References

1. Moore, G. Cramming more components onto integrated circuits. *Electronics* **1965**, *38*, 114–117. [CrossRef]
2. Aagard, A. *Digital Business Models: Driving Transformation and Innovation*, 1st ed.; Palgrave Macmillan: Cham, Switzerland, 2019; pp. 255–260.
3. Schallmo, D.; Williams, C. *Digital Transformation Now! Guiding the Successful Digitalization of Your Business Model*, 1st ed.; Springier: Cham, Switzerland, 2018; pp. 15–33.
4. Measuring the Digital Transformation: A Roadmap for the Future. Available online: https://www.oecd.org/going-digital/measurement-roadmap.pdf (accessed on 21 September 2021).
5. Nashelsky, L. *Introduction to Digital Technology*, 4th ed.; Prentice-Hall: Hoboken, NJ, USA, 1994; pp. 3–4.
6. Vermaat, M.; Sebok, S.; Freund, S.; Campbell, J.; Frydenberg, M. *Discovering Computers: Digital Technology, Data, and Devices*, 1st ed.; Cengage Learning: Boston, MA, USA, 2018.
7. Urbinati, A.; Chiaroni, D.; Chiesa, V.; Frattini, F. The role of digital technologies in open innovation processes: An exploratory multiple case study analysis. *R&D Manag.* **2020**, *50*, 136–160. [CrossRef]
8. Khin, S.; Ho, T.C. Digital technology, digital capability and organizational performance: A mediating role of digital innovation. *Int. J. Innov. Sci.* **2019**, *11*, 177–195. [CrossRef]
9. Brennen, J.S.; Kreiss, D. Digitalization. In *The International Encyclopaedia of Communication Theory and Philosophy*, 1st ed.; Jensen, K.B., Rothenbuhler, E.W., Pooley, J.D., Craig, R.T., Eds.; John Wiley & Sons: Hoboken, NJ, USA, 2016. [CrossRef]
10. Ghosh, S.; Mohammed, K.S.; Mogal, N.; Nayak, P.K.; Champaty, B. Smart Attendance System. In Proceedings of the International Conference on Smart City and Emerging Technology (ICSCET), Mumbai, India, 5 January 2018; pp. 1–5. [CrossRef]
11. Kakarla, S.; Gangula, P.; Rahul, M.S.; Singh, C.S.C.; Sarma, T.H. Smart Attendance Management System Based on Face Recognition Using CNN. In Proceedings of the 2020 IEEE-HYDCON, Hyderabad, India, 11–12 September 2020; pp. 1–5. [CrossRef]
12. Madlenak, R.; Madlenaková, L. Digital Advertising System in Urban Transport System of Žilina Town. *Transp. Telecommun. J.* **2014**, *15*, 215–226. [CrossRef]
13. Madlenak, R.; Svadlenka, L. Acceptance of internet advertising by users in the Czech Republic. *E&M Ekon. Manag.* **2009**, *12*, 98–107.
14. Rovnanova, A.; Rostasova, M.; Valica, M. Value chains as the tools for differentiation of offer in services. *Transp. Commun. Sci. J.* **2016**, *4*, 27–31. [CrossRef]
15. Madlenak, R.; Madlenakova, L.; Rudawska, A. Viral marketing as part of effective university marketing strategy. In Proceedings of the 11th International Conference on Technology, Education and Development (INTED), Valencia, Spain, 6–8 March 2017; pp. 5629–5635.
16. Wachal, R. Humanities and Computers: A Personal View. *N. Am. Rev.* **1971**, *256*, 30–33.
17. Savić, D. From Digitization, through Digitalization, to Digital Transformation. *Online Search.* **2019**, *43*, 36–39.
18. Madlenak, R.; Madlenakova, L.; Kolarovszka, Z. System of management and traceability of logistic items through new technologies. *Procedia Soc. Behav. Sci.* **2016**, *230*, 128–135. [CrossRef]
19. Digital Transformation: Changes and Chances. Fraunhofer Institute for Applied Information Technology. Available online: https://fim-rc.de/wp-content/uploads/2020/02/Fraunhofer-Studie_Digitale-Transformation.pdf (accessed on 22 August 2021).

20. Digital Business Transformation. Available online: https://www.imd.org/research-knowledge/articles/digital-business-transformation/ (accessed on 22 August 2021).
21. Genzorova, T.; Corejova, T.; Stalmasekova, N. How digital transformation can influence business model, Case study for transport industry. *Transp. Res. Procedia* **2019**, *40*, 1053–1058. [CrossRef]
22. Schilirò, D. Towards Digital Globalization and the Covid-19 Challenge. *Int. J. Bus. Manag. Econ. Res.* **2020**, *11*, 1710–1716.
23. Garbarova, M.; Holla Bachanova, P. Purchasing behaviour of e-insurance. In *Vision 2020: Sustainable Economic Development and Application of Innovation Management from Regional Expansion to Global Growth, Proceedings of the 33rd IBIMA Conference, Granada, Spain, 10–11 April 2019*; IBIMA: King of Prussia, PA, USA, 2019; pp. 3139–3152.
24. Akaev, A.; Sarygulov, A.; Sokolov, V. Digital economy: Backgrounds, main drivers and new challenges. *SHS Web Conf.* **2018**, *44*, 00006. [CrossRef]
25. Zimmermann, H. Understanding the Digital Economy: Challenges for New Business Models. In Proceedings of the AMCIS 2000, Long Beach, CA, USA, 10–13 August 2000.
26. Ristvej, J.; Lacinak, M.; Ondrejka, R. On Smart City and Safe City Concepts. *Mob. Netw. Appl.* **2020**, *25*, 836–845. [CrossRef]
27. Bukht, R.; Heeks, R. Defining, Conceptualising and Measuring the Digital Economy. *Dev. Inform. Work. Pap.* **2019**, *68*, 1–26. [CrossRef]
28. Madudova, E.; Majercakova, M. The influence of university-firm cooperation on firm value. In Proceedings of the 2017 16th International Conference on Information Technology Based Higher Education and Training (ITHET), Ohrid, North Macedonia, 10–12 July 2017; pp. 1–6.
29. Chinoracky, R.; Corejova, T. How to evaluate the digital economy scale and potential? *Entrep. Sustain. Issues* **2021**, *8*, 536–552. [CrossRef]
30. Riasanow, T.; Galic, G.; Böhm, M. Digital transformation in the automotive industry: Towards a generic value network. In Proceedings of the 25th European Conference on Information Systems (ECIS), Guimarães, Portugal, 5–10 June 2017; pp. 3191–3201.
31. Stalmasekova, N.; Genzorova, T.; Corejova, T.; Gasperova, L. The impact of using the digital environment in transport. *Procedia Eng.* **2017**, *192*, 231–236. [CrossRef]
32. Gasova, K.; Stofkova, K. E-Government as a Quality Improvement Tool for Citizens' Services. *Procedia Eng.* **2017**, *192*, 225–230. [CrossRef]
33. Ball, M.J.; Lillis, J. E-health: Transforming the physician/patient relationship. *Int. J. Med Inform.* **2001**, *61*, 1–10. [CrossRef]
34. Porterfield, A.; Engelbert, K.; Coustasse, A. Electronic prescribing: Improving the efficiency and accuracy of prescribing in the ambulatory care setting. *Perspect. Health Inf. Manag.* **2014**, *11*, 1g.
35. Digitalisation and Productivity. Available online: https://www.oecd.org/economy/growth/digitalisation-productivity-and-inclusiveness/ (accessed on 23 August 2021).
36. Digital Dividend: Policies to Harness the Productivity Potential of Digital Technologies. Available online: https://www.oecd-ilibrary.org/deliver/273176bc-en.pdf?itemId=%2Fcontent%2Fpaper%2F273176bc-en&mimeType=pdf (accessed on 23 August 2021).
37. Productivity Growth in the Digital Age. Available online: https://www.oecd.org/going-digital/productivity-growth-in-the-digital-age.pdf (accessed on 23 August 2021).
38. Chinoracky, R.; Corejova, T. Impact of Digital Technologies on Labour Market and the Transport Sector. *Transp. Res. Procedia* **2019**, *40*, 994–1001. [CrossRef]
39. Schwab, K. *The Fourth Industrial Revolution*, 1st ed.; Crown Business: New York, NY, USA, 2017; pp. 39–50.
40. Hernandez, K.; Faith, B.; Martín, P.P.; Ramalingam, B. *The Impact of Digital Technology on Economic Growth and Productivity, and Its Implications for Employment and Equality: An Evidence Review*, 1st ed.; Institute of Development Studies: Brighton, UK, 2016; pp. 25–28.
41. Economic Indicator. Available online: https://www.britannica.com/topic/economic-indicator (accessed on 23 August 2021).
42. Toolkit for Measuring the Digital Economy G20 Report. Available online: https://www.oecd.org/g20/summits/buenos-aires/G20-Toolkit-for-measuring-digital-economy.pdf (accessed on 23 August 2021).
43. A Roadmap toward a Common Framework for Measuring the Digital Economy: Report for the G20 Digital Economy Task Force. Available online: http://www.oecd.org/sti/roadmap-toward-a-common-framework-for-measuring-the-digital-economy.pdf (accessed on 23 August 2021).
44. Kononova, K. Some Aspects of ICT Measurement: Comparative Analysis of E-Indexes. In Proceedings of the 7th International Conference on Information and Communication Technologies in Agriculture, Food and Environment, Kavala, Greece, 17–20 September 2015; pp. 938–945.
45. Moroz, M. The level of development of the digital economy in Poland and selected European countries: A comparative analysis. *Found. Manag.* **2017**, *9*, 175–190. [CrossRef]
46. Chinoracky, R. Hodnotenie Potenciálu Digitálnych Technológií pri Transformácii Podnikov, Hospodárstva a Spoločnosti. Ph.D. Thesis, University of Zilina, Zilina, Slovakia, 2021; p. 133.
47. OECD STAN STructural ANalysis Database. Available online: http://www.oecd.org/industry/ind/stanstructuralanalysisdatabase.htm (accessed on 23 August 2021).
48. OECD STAN–Industry List. Available online: http://stats.oecd.org/wbos/fileview2.aspx?IDFile=f237408a-b8f5-4ed9-b0d3-868e4b394a90 (accessed on 23 August 2021).

49. Digital Economy and Society Database–Digital Skills. Available online: https://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database (accessed on 23 August 2021).
50. Information and Communication Database OECD. Available online: https://stats.oecd.org/Index.aspx?DataSetCode=ICT_BUS (accessed on 23 August 2021).
51. A New Comprehensive Digital Skills Indicator. Available online: https://ec.europa.eu/digital-single-market/en/news/new-comprehensive-digital-skills-indicator (accessed on 23 August 2021).
52. The Future of Work–OECD Employment Outlook 2019. Available online: https://read.oecd-ilibrary.org/employment/oecd-employment-outlook-2019_9ee00155-en#page1 (accessed on 23 August 2021).
53. OECD National Accounts Statistics. Available online: https://www.oecd-ilibrary.org/economics/data/oecd-national-accounts-statistics_na-data-enn. (accessed on 23 August 2021).
54. OECD Education and Training. Available online: https://www.oecd.org/statistics/data-collection/educationandtraining.htm (accessed on 23 August 2021).
55. UNSTAD Statistics. Available online: https://unctad.org/statistics (accessed on 23 August 2021).
56. EUROSTAT Education and Training. Data. Database. Available online: https://ec.europa.eu/eurostat/web/education-and-training/data/database (accessed on 23 August 2021).
57. OECD: Going Digital: Shaping Policies, Improving Lives. Available online: https://www.oecd.org/going-digital/going-digital-synthesis-summary.pdf (accessed on 21 September 2021).