

EU Countries' Performance in Digitalization



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Abstract Digital transition represents one of the main objectives of the European Commission, and the current pandemic context is considered an ‘opportunity’ to accelerate the implementation of new digital technologies, which, in line with the climate neutrality goal, contribute to transforming today’s Europe into a more resilient and functional one. However, evidence from across the globe shows that the digital transition process has different levels of implementation in EU countries. Based on the DESI data we analyzed the evolution of the digital transition in EU Member States and answered the question which Member States are performing best in terms of digitization and which are the least performing ones, in order to provide a macro-perspective regarding the structure of the digitalization process. In the second part, the analysis focuses on the current trends in digital transition in Finland, Sweden, Romania and Bulgaria, including pandemic period in order to see its impact. The results indicated that there is a gap between Member States regarding the level of digitalization. Each domain of DESI is important, there are countries that have good results in two areas but have poor results in the other three and overall they obtain a low score. The pandemic has slowed down the implementation of digitalization policies. However, there is a good improvement regarding e-commerce area and not only. This paper mainly contributes to the intensification of debates on digitalization in order to identify as many policies as possible that increase the level of digitalization and reduce the existing gap.

Keywords Digital Gap · Digital Economy · Society Index · Digital Transition

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1 Introduction

Ensuring a green and digital transition is currently one of the top priorities in Europe. Actions to achieve this include examining human implications, strengthening the digital skills of Europeans, and digitizing the public institutions.

The need to intensify the digitalization process was highlighted during the 2019 European Semester, where Member States received clear recommendations on stepping up the efforts to strengthen digital technologies and other components involved in the digitization process. The recommendations focused mainly on the development of citizens' digital skills as well as on the efforts to ensure an infrastructure that allows the use of new technologies, taking into account regional disparities.

Digitization can be perceived as a new dimension of globalization. Like any other transition, this process has both associated costs as well as numerous benefits. A higher degree of digitization can lead to better policy development, more sustainable business models, new jobs and income opportunities. To benefit from all these opportunities requires significant changes in infrastructure, education, regulation and governance. Clearly, this will require considerable financial resources but especially a concentrated effort from all socio-economic actors. In addition to the beneficial effects that digitalization can generate regarding the development and progress, it also raises a series of concerns about their impact on society, largely related to rising income inequalities and unemployment (by replacing human labor).

Regarding the current state of digitalization in the European Union, progress can be compared through the Digital Economy and Society Index (DESI) which is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU Member States in digital competitiveness. DESI has been used since 2014 as a benchmarking tool in the digitalization process.

The aim of this paper is to highlight the evolution of the digitization process in EU Member States and to show there is a gap between them, using the most recent data, including the pandemic period. But the important result is to find which are the factors and premises that contribute in a negative way to digitalization process. We used DESI and its individual components, as well as other relevant indicators to capture the effects of the pandemic on the level of digitization. We also analyze the evolution of the two best performing countries, compared to the least two performing countries. This analysis will allow us to better understand, from the digital transition perspective, where are the non-functional areas and how this process can be accelerated to reduce the gaps in Europe.

Finally, we propose a series of recommendations to improve the level of digitization. We show how the best performing economies in the European Union behave compared to the least performing in terms of digitization. On the one hand, we must take into account the gaps present at the aggregate level, but at the same time the significant regional differences in our country force us to take into account the sub-national level, an analysis that will be carried out in further research.

2 Literature Review

The current European context is characterized by the beginning of a period of digital transition corresponding to the fourth industrial revolution. Also, the current pandemic crisis highlights the need to increase the level of digitalization both in production processes, but also in areas such as education and health.

In order to measure the level of digitalization of the economy and society, we have several indices, scores, indicators, and measurement units that indicate the evolution of this process. Regarding the European Union, DESI is considered the most appropriate and robust method for mapping Europe's progress on digitalization (Banhidi et al., 2020).

There are numerous authors who include the DESI index in them analyzes regarding digitization. There was analyzed the influence of the consumption index growth by the purchasing power parity and unemployment among the active population on the structural units of DESI (Stavytskyy et al., 2019). Using the panel regression, the authors have proven that a 1% increase in the consumption index results in about 0.2 increase in the DESI, and an increase in unemployment by 1% leads to about 0.2 DESI decline. It is also shown that the 98% value of DESI is actually determined by its previous trends, and therefore it is impossible to increase this index rapidly. Stoica and Bogoslov (2017) compared the data of the five areas of DESI for Romania and European Union. They conclude that a low performance in one of these areas is affecting the whole level of digitalization of Romania. At UE level they notice that the EU members should struggle for reducing the existing difference regarding their performance.

An important discussion when talking about a digital economy and society is related to the economic and social effects that this transformation brings. The changes that are taking place in the economy and society must have at their center the individual and its needs. The poverty rate, unemployment and economic and social inequalities are still high in the European Union, so European citizens are still waiting for measures to improve their daily lives. According to Deaton (2013), The Industrial Revolution in Britain (eighteenth-nineteenth centuries) was responsible for the economic progress and relieving from poverty hundreds of millions of people. Today people are better fed, more educated, and life expectancy grew. The industrial revolution has also created new jobs and better income opportunities.

There are studies that conclude that the digital revolution will have a positive effect on the economy and society, but there are also studies that emphasize that it will lead to job losses and significant changes in the structure of the economy and jobs. According to the growth strategy, the technological revolution is an important source to increase productivity and stimulate economic growth (Solow 1956).

Regarding the impact of technological revolution Arntz et al. (2016) analyzed the risk of automation for jobs in OECD countries. Their analysis suggests that 9% of OECD jobs are potentially automatable. However, there is a major difference between countries, while the share of automatable jobs is 6% in Korea, the corresponding share is 12% in Austria. An explanation for this could be the differences in workplace

organization, differences in previous investments into automation technologies as well as differences in the education of workers across countries. They pointed out that the automation and digitalization process are unlikely to affect a major number of jobs. A few arguments are that the digitalization is a slow process, workers can adjust to changing technological endowments by switching tasks, thus preventing technological unemployment and additional jobs will be created. However, those who will be affected are part of the category of low-skilled workers. Even if the results are important, this study has its limitations. The analysis takes into consideration technological capabilities rather than the actual utilization of such technologies, they consider only existing jobs, although new technologies are likely to create also new etc.

Another study with reference to the impact of digital technologies on the economy and society (Vasilescu et al., 2020) examines the hypothesis that digital divide leads to creation of vulnerable citizens or countries groups. Also, included the general perception of the respondents on the impact of recent digital technologies on the economy, on society, and the quality of life, using The Eurobarometer 87.1 Survey. They applied TwoStep Cluster Analysis (TSCA) with the aim to create homogeneous groups of people in terms of three aspects related to digitalization: the attitude towards digitalization, the perception of EU citizens on their own digital skills and the actual use of technology. They found out interesting results, women tend to be more afraid than men about the implication of the workplace digitalization and the most vulnerable category in digitalization era is formed by the people over 55 years, with a low level of education and a low level of income and little internet use, mostly from the Hungary, Romania, Greece and Bulgaria. One of the major limitations of this study is the subjective perception of people that was taken into account.

Among the positive effects of the digital transition on the labor market, we mention the increase in the number of highly skilled workers (Acemoglu and Restrepo, 2017); environmental sustainability (more precisely in the manufacturing process - digitalization allows the development of ecological manufacturing processes) (De Sousa Jabbour, 2018); improving health technologies, etc. The new technology can help both society and the environment, but there are concerns that it may threaten the confidentiality of personal data, erode security, or even deepen income inequality.

Digitalization leads to rapid changes in the labor market, influencing the nature, quality, and productivity of labor. Thus, policy makers face the challenge of using digitalization to support economic growth and employment - while ensuring decent working conditions, social protection and equal opportunities for all (COM, 2019).

3 Methodology

In our analysis, we first established the hypothesis of the paper, namely that there is a gap in the process of digitization in the EU Member States. We wanted to determine which are the factors that place Romania on the bottom of the digital classmen. In order to understand the evolution of the digitalization process in the EU, and to

test the hypothesis of the paper, we used the DESI indicator (The digital economy and society index), a composite measure that summarizes indicators related to the digital performance and digital competitiveness at the level of European Union. It comprises five sets of data related to: the degree of connectivity; human capital; use of internet services; integration of digital technologies; digital public services. The lack of DESI data for 2020 led us to identify other indicators that we considered substitutes for DESI components in order to capture the evolution of digitization during the pandemic.

We used both quantitative and qualitative methods. We analyzed the data for each of the 5 dimensions of the index for the 27 EU countries. The data series are annual. We interpreted the variables in a comparative manner that highlights the performing states in terms of digitization and the less performing ones. We took into consideration the structural dimension in terms of digital evolution but also the conjuncture dimension of this process.

We started by analyzing the DESI indicator at Member State level in 2020, and continued to explore each component of this indicator, taking into account the data series for 2019 and 2020. Thus, we monitored the evolution of each component in EU countries and presented in a comparative way that there is a gap between Member States and which are the best performing countries compared to the worst performing. We found that there are states that record very good results in some components and poor results in others.

In the last part of the analysis we chose two of the most performing countries Finland and Sweden and two of those with the worst results regarding the digitalization of Romania and Bulgaria, and we surprised the evolution in recent years, including the pandemic period. It was important to determine the causes of poor performance and also the capacity in terms of the digital process.

4 Results and Discussions

The need to digitize the European economy has been debated for several years, but the crisis caused by Covid 19 has led policymakers to decide on digitalization as a key pillar of the EU's recovery. More than ever, the European Union is determined to take the necessary steps for a digitized and green European future that supports sustainable development. Thus, EU wants 20% of the Recovery Plan fund to be used by Member States to implement public policies that support the digital transition.

Digital transition can respond both to the challenges the European community is facing and to bring added value to both companies and society. In addition to increasing competitiveness and innovation, a digital economy helps to create new jobs and to improve education and social inclusion. Thus, a digital economy refers not only to the way we communicate but also to the way we work and live. All these changes can increase economic well-being and generate social progress.

The areas of action established for the transition to a digital Europe are numerous and include important segments of everyday life, such as ensuring the protection of

online operations, digitizing the public sector, ensuring greater connectivity for all European households, digitizing justice, the medical sector and last but not least the digitalization of education. By ensuring adequate public policies in these areas and by respecting European values and the fundamental rights of citizens, Europe can achieve its ambitious goals of creating a digital economy and society.

In terms of measures, EU Member States have as examples Finland and Sweden which have a high index in terms of digitization. Finland, for example, is very advanced in digital skills and the digitization of business indicators as well as in digital public services. During the pandemic, numerous digital projects were implemented in Finland to help the population in terms of the correctness of the information related to Covid 19, psychiatric support programs, etc.

During the pandemic, Sweden implemented digital projects to help teachers teach online. Thus, online courses were organized for distance learning, materials and digital resources necessary for online teaching were made available. Another important digital project implemented by Sweden concerns the development of communication channels between those in the field of health and patients or relatives of patients. The physical distance that the pandemic imposed made it difficult for some of the patients diagnosed with chronic diseases to visit a doctor and also for the medical staff and the relatives of the hospitalized patients to communicate.

The pandemic caused by Covid 19 highlighted the digitization issue in the EU. Most employees were forced to work from home, needing high-speed internet; also, certain services, such as paying taxes or bills were digitalized to avoid as much as possible travel and the risk of virus contamination. A large part of companies (especially sales companies) was forced to transfer its business online because of the travel restriction. Thus, it is a good time to analyze what has been achieved at European level in terms of digitalization and what measures are needed to accelerate the process in order to close the gap between EU countries.

To measure the level of digitization achieved in a country, the European Commission has developed the Digital Economy and Society Index (DESI), a composite index that encompasses indicators related to the digital performance and digital competitiveness of EU Member States. Depending on its level, Member States may decide to implement support policies for a particular component (COM, 2020) (Fig. 1).

It is important to note that the best performing states in digital terms do not correspond to the best performing states in terms of the economy, but in the pandemic context, steps have been taken to implement new digital strategies to help improve carrying out activities in crisis situations and not only. These measures will be visible in DESI from the end of 2021. It should be noted that the indicators that make up this Index are influenced and for example, a country that has not made investments in terms of Human Capital will also have low results in terms of the Use of internet indicator. Italy is in this situation, although in terms of connectivity it is at the EU average, very low investments in basic and advanced digital skills have led to a very low rate in the use of online services, including digital public services. For these reasons, Italy, a country with a developed economy, is at the bottom of the Digital Economy and Society Index. The Connectivity component refers to the demand and supply of fixed and mobile broadband. Among the best performing countries in this

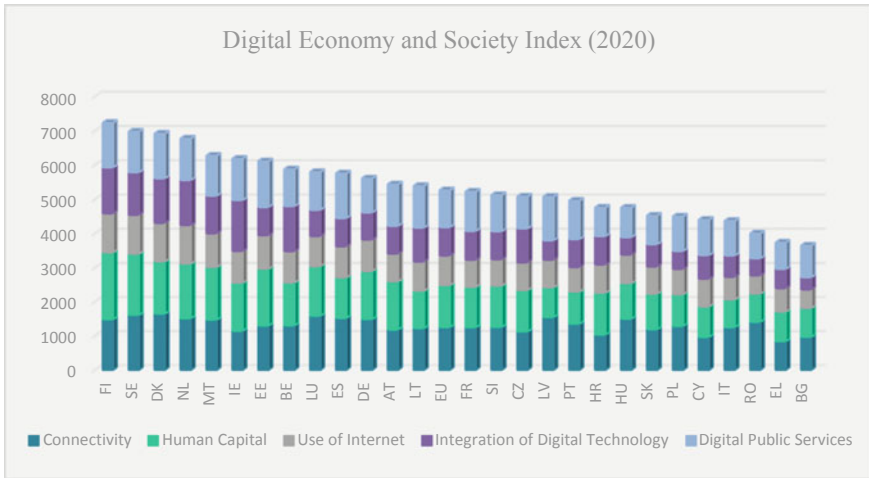


Fig. 1 Digital Economy and Society Index 2020. *Source* Eurostat data

regard are Denmark, Sweden, Luxembourg, and at the opposite pole are Greece, Cyprus, Bulgaria. Although Romania has a good level of connectivity (11th / 27th place), due to the high use of very high speed broadband and the wide availability of high capacity fixed networks, especially in urban areas, it only ranks 26th in the 27 EU Member States in the Digital Economy and Society Index (DESI) for 2020 because areas such as the Use of the Internet or the Integration of Digital Technology are underused. Romania’s poor performance in the digital field can be attributed both to the living standards of the population (ensuring basic needs, the need to improve infrastructure in both rural and urban areas), but also to the ever-changing political developments along with development projects (Fig. 2).

In the process of digitization, Connectivity is not enough, it is necessary for the population to have as many skills in using connectivity in order to benefit from the opportunities of digitization. Thus, Human Capital aims at the degree of empowerment of citizens in using the Internet; they can be basic skills, which would make daily activities easier or they can be advanced skills, which have the role of specializing as much labor as possible, therefore, they would contribute to reducing poverty and income inequality (Fig. 3).

Although it is clear that the pandemic can have a positive impact on increasing the number of internet users, the development of digital skills does not automatically come with increased use, it is supported by measures at national level to improve the skills of individuals. There is a significant discrepancy between rural and urban areas in terms of digital skills, and this can be an investment opportunity for policy makers.

With Connectivity and Human Capital, there are several activities that require Use of internet, these activities with online content can be jobs, conferences, entertainment activities. In the context of isolation, much of the time spent outside the

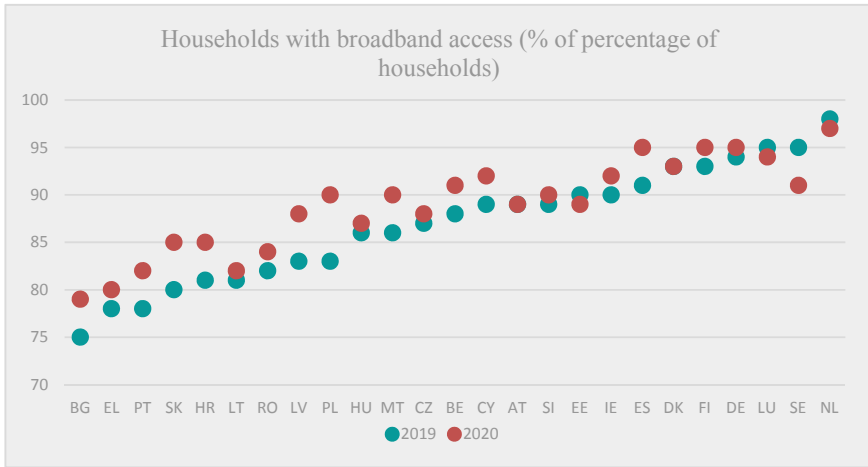


Fig. 2 Households with broadband access (% of percentage of households). *Source* Eurostat data

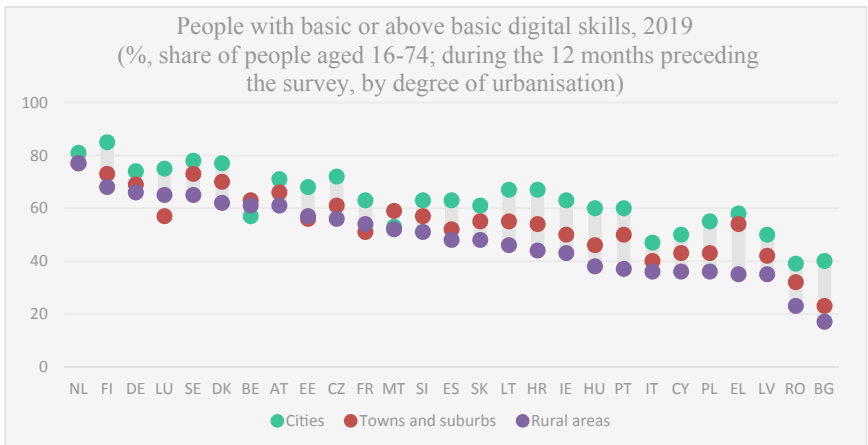


Fig. 3 People with basic or above basic digital skills, 2019. *Source* Eurostat data

home has been replaced by time spent indoors, with online activities being the most convenient choice. This activity is not available for DESI 2020, but can be seen in an increase in the Internet use indicator available for both 2019 and 2020 (Fig. 4).

Most Member States have seen increases in the use of the Internet in 2020 compared to 2019, this increase is due to the “stay at home” measures imposed during the pandemic. The highest increase in the percentage of the population that registered growth is found in SK, RO, CY, SI, and the states that registered decreases in internet use are SE, NL, EE, countries that did not impose restrictions during the pandemic (SE), or who quickly relaxed the restrictions.

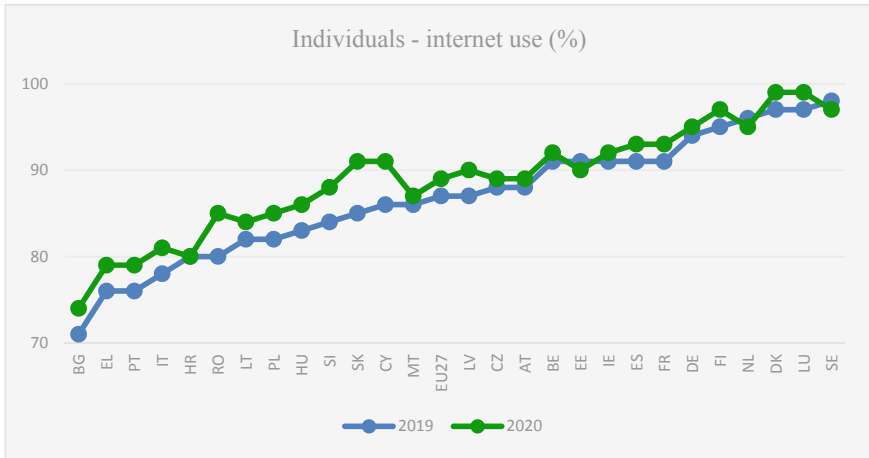


Fig. 4 Individuals - internet use (%). *Source* Eurostat data

Regarding the Integration of digital technology, it measures the degree of digitalization of enterprises and e-commerce. Online commerce has enjoyed a significant rise in some countries such as (RO, HU, HR). Of all these, by far, Romania registered the highest increase among the leading countries (15 pp), and at the opposite pole are EE, SK, SE, FI (between 0 and 3 pp) (Fig. 5).

The fifth component of the DESI index is represented by Digital Public Services, which provides an assessment of the degree of implementation of digitization in public services. The current context highlights the benefits of technology and of the digitization of public services, and the development priorities of all states in the near

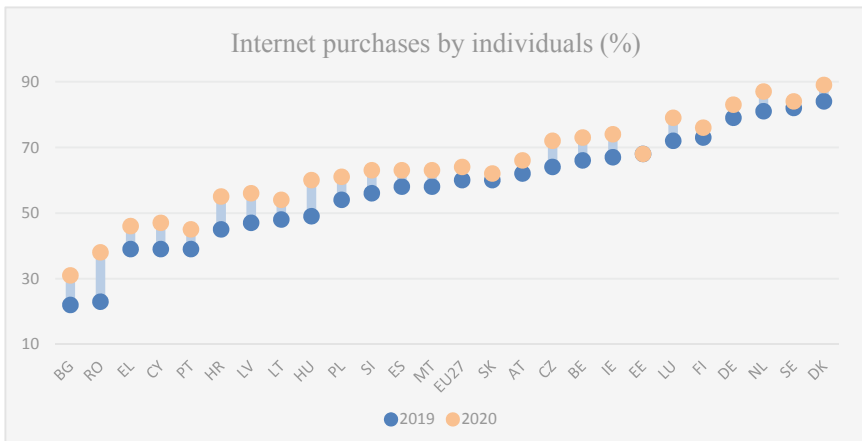


Fig. 5 I Internet purchases by individuals (%). *Source* Eurostat data

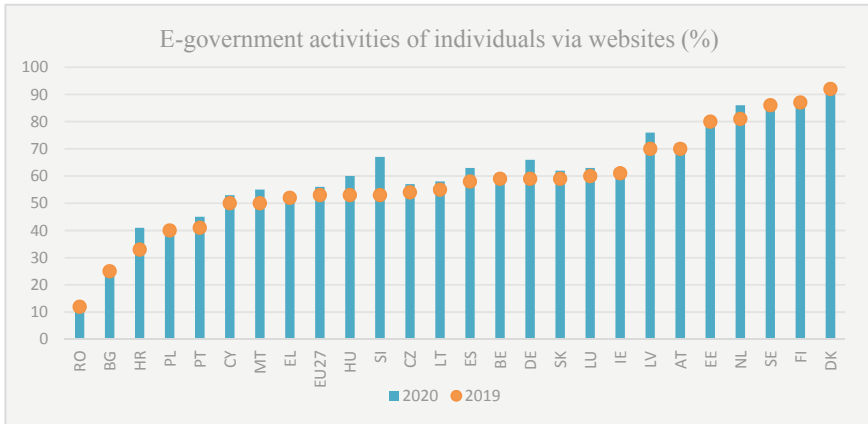


Fig. 6 E-government activities of individuals via websites (%). *Source* Eurostat data

future should include this key issue. For Romania, the digitalization of public services has proved useful during the state of emergency, and the extension of this practice at the level of institutions has already become a priority on Romania’s strategic development agenda (Fig. 6).

The graphs below show the data of the 5 indicators that make up the Digital Economy and Society Index for 2019 and 2020 in the case of the best performing countries Finland and Sweden and in the case of the least performing countries Romania and Bulgaria. As we can see, the proximity of the indicator axes means a high score, while the location of the axes further inland indicates a lower score.

There is a gap in terms of the 5 indicators for the four countries analyzed. There is a slight convergence regarding Connectivity, Finland has a score of 54.5% in 2019 and 59.2% in 2020, Sweden recorded a score of 60.1% in 2019 and 64.4% in 2020, Romania in 2019 had a score of 50% and in 2020 a score of 56.2% and Bulgaria managed to reach in 2019 a score of 37.2% and in 2020 one of 38.5%. In the case of all 4 analyzed countries, there is an increase in the score in 2020 compared to 2019, which shows that measures have been taken in this area. For example, Romania improved in terms of coverage while stagnating in terms of take-up. Sweden has achieved a 66% take-up rate for at least 100 Mbps fixed broadband, almost two and a half times the EU average of 26%. Very high capacity network coverage also increased, reaching 77% (compared to 72% in 2018), exclusively thanks to FTTP networks, and Sweden now ranks eight at EU level.

The biggest divergence is in Human Capital, Finland and Sweden are above the EU average of 49.3% in 2020. Sweden has a score of 71.1% in 2020 and Finland a score of 78.4%. Romania and Bulgaria have half the scores recorded by Sweden and Finland, and are well below the EU average. Romania recorded a score of 33.2% in 2020 and Bulgaria a score of 33.9%. According to the European Commission, in Romania less than a third of the people aged 16 to 74 have at least basic digital skills, while 35% have at least basic software skills, compared to the EU average of 61%.

IT specialists represent only 2.2% of the workforce in Romania, while in the EU the average is 3.9%. Romania ranks well among graduates in the IT field, approximately 5.6% of all Romanian graduates are in the IT field, which ranks Romania 5th among Member States.

Regarding digital public services, there is a slight convergence of scores in Finland, Sweden and Bulgaria but Romania remains the last in the EU, with only 48.4% in 2020 well below the EU average of 72%. Regarding the other two indicators, Use of internet and Integration of Digital Technology, the axes indicate major gaps between the countries performing at the level of digitization Finland and Sweden and the less performing countries at the level of digitization Romania and Bulgaria. The scores recorded by Romania and Bulgaria in 2020 are only half of those recorded by Finland and Sweden.

For the Fig. 7, 4 revealing indicators were selected to measure the degree of digitization, noting that these data also capture the effects of the pandemic on digitization. The data presented in the previous graphs represent some scores established based on the information from the year prior to the report.

As we can see, the pandemic has also slowed down the implementation of digitalization policies. The four selected countries made little progress in 2020 compared to 2019, in terms of the 4 indicators. Regarding internet access in 2020, there is a high degree of convergence between the 4 countries, Bulgaria, Romania and Finland registered small increases of the indicator compared to 2019, except for Sweden which registered a small decrease. One possible explanation may be the difficult economic situation of some consumers, caused by the pandemic, who have chosen to give up internet subscriptions. The same situation is encountered in internet use, the only country that has registered a decrease is Sweden, this may be a consequence

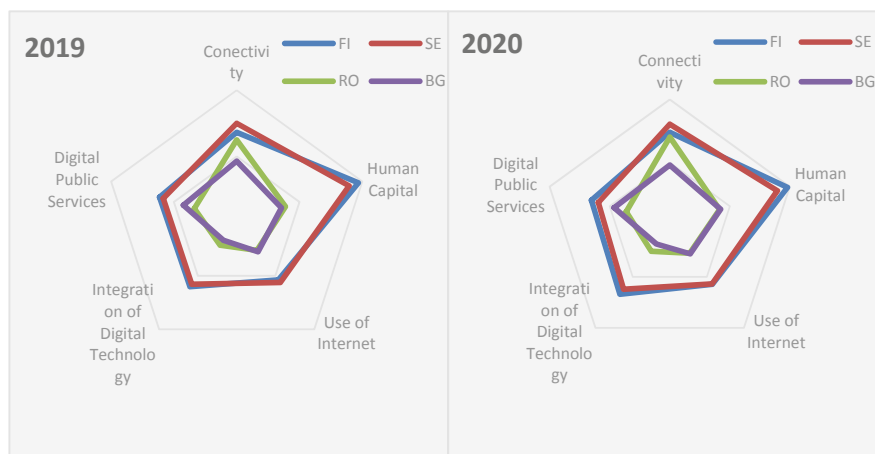


Fig. 7 DESI 2019 – 2020. Source Eurostat data

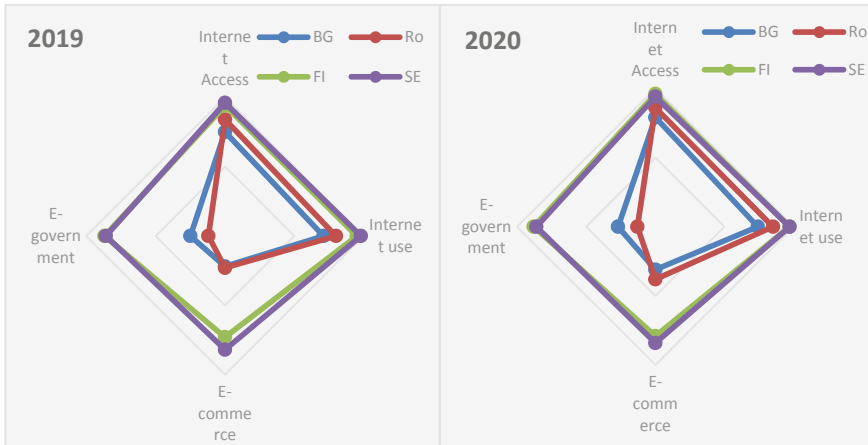


Fig. 8 DESI FI, SE, RO, BG. *Source* Eurostat data

of the fact that this country was the only one in the EU that did not adopt lockdown measures during the pandemic. Since some consumers have given up internet subscriptions, the use of the internet has also decreased.

As we can see, the pandemic has also slowed down the results of implementation of digital policies. To understand better the data and the results we have to take into account the principle of dynamic inconsistency over time. There is a strong need for a coherent digital strategy and an adequate and fast implementation process in terms of digitalization policies. The four selected countries made little progress in 2020 compared to 2019, in terms of the 4 indicators. Regarding internet access in 2020, there is a high degree of convergence between the 4 countries, Bulgaria, Romania and Finland recorded small increases in the indicator compared to 2019, except for the other two indicators, E-government and E-commerce we notice a big gap between countries both in 2019 and in 2020.

The aggregate data recorded by Romania and Bulgaria are only half of those recorded by Finland and Sweden. A major and important evolution during the pandemic, we see in Romania and Bulgaria in terms of e-commerce. This shows that companies have adapted to the conditions of the pandemic and moved sales online. The restriction of the right to movement of citizens, determined the companies to invest in the digitalization of trade so that they can continue their business. Unfortunately, we do not encounter the same situation regarding the E-government indicator. The progress made during the pandemic is minimal in the case of Romania and Bulgaria, which shows that state institutions have not implemented measures regarding digitization at the same rate as companies have done.

5 Conclusions

The transition to a digital economy is a process that has become a priority and stringent for every state in the European Union. The pandemic caused by the covid-19 virus accentuated the need for the digitization process. Most people worked from home, school took place online, the right of movement was restricted so that the internet and online operations became indispensable. From shopping online, paying bills or communicating the results of online medical analysis, EU citizens have felt the benefits of the digitization process.

Unfortunately, not all EU countries are equally developed in terms of digitalization. Through this analysis we managed to prove that the hypothesis of the paper is valid, there is a gap in the digital transition at EU level. The countries that have the best performance in the digital process are the countries in the Nordic sub model and those with the worst results are in the central-eastern countries.

DESI index uses data from 2019, so there is a possibility that the next report will show the progress of many countries that have implemented policies during the pandemic. For this reason, in the second part of the paper we analyzed for Finland, Sweden, Romania and Bulgaria 4 indicators to capture the evolution of the digital process during the pandemic. The data showed that the private sector has adapted to the conditions imposed by the pandemic and has invested in digitalization. At the governmental level, the data indicate little progress, but usually these investments require more time so the results can be seen in the coming years.

The role of public institutions in this process is defining and would allow an accelerated absorption of the digital gaps compared to other European countries. From the E-Government perspective Romania occupies the last place in the ranking of EU countries. The fact that certain components of digital process achieved a very good level, similar to those of the best performing countries (high connectivity and high degree of internet use) clearly shows us that Romania has the capacity to accelerate the digitization process in the next period.

As a recommendation, EU member states need to implement policies to improve citizens' skills in internet uses, which would allow them access to much better paid jobs or keep their current jobs. As mentioned in the literature, people at risk of losing their jobs as a result of digitization are part of the category of people with low internet skills. Member States must take into account public policies that favor these vulnerable groups in order to protect them from unemployment and inequality.

The European Union has made digitalization one of the main keys to post-pandemic recovery and has allocated substantial funding to this end. The responsibility of EU countries is to identify and implement the best public policies that will increase the degree of digitalization and produce added value in the economy and society.

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