

EUROPE'S STRUGGLE AND TRANSFORMATION IN AN ALMOST FULLY DIGITIZED WORLD

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Abstract

In a society where technology represents the main preference of most individuals and an integrated part of their lives, the need for digitization becomes imminent. At global level, each state makes considerable efforts towards the implementation of policies and scenarios that support the development using advanced ICT tools.

The present paper intends to address the main issues related to how Europe manages its digital transformation. Topics such as the evolution of the last years with regards to the digitization of the EU member states and the position of Europe globally from the perspective of the degree of digitization will be considered. The article will also highlight the points where the EU excels in terms of digitization as well as the main gaps it faces. Moreover, the future directions through which the EU intends to improve its transition to a fully digital world will be highlighted.

Keywords: *Technology, Europe, Digital World, DESI, I-DESI*

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1. Introduction

The development of ICT and related fields over time determined the transition from traditional activities to a world within which almost everything is supported by intelligent technological devices. This technological progress exerts its influence on each sphere of our daily life, starting from changing the

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paradigm of communication and relationship formation to the way we undertake basic activities, such as purchase of products, payment of invoices and so on.

In addition to the ubiquity of technology in our personal lives, we cannot neglect the major benefits it brings over all existing domains, including but not limited to education, medicine and economics. In fact, we are witnesses and active beneficiaries of the continuous and rapid process of digitization. We can say that the technology and the mediums supported by the Web, do not represent only a dependency of the current society but, in fact, a lifestyle, the preference and the necessity of the contemporary world.

Digitization requires combining knowledge, skills and expertise that, in practice, supported by the necessary investments and infrastructure, facilitates the path to a digital world. By recognizing these issues and understanding the importance of digitization, globally, each state is making major efforts to sustain the integration of modern technology into each activity.

As for the European Union (EU), digitization is both a chance for development and a challenge. In this regard, in 2015 the Digital Single Market Strategy (DSM Strategy) was adopted, which represents one of the 10 political priorities set by the European Commission. The main objective of the DSM Strategy is to improve Europe's position as a world leader in the digital economy, which would lead to increased digital opportunities for both people and businesses.

As per the European Commission (European Commission, 2019), digital transformation, referring to both businesses and society as a whole, is *“characterised by a fusion of advanced technologies and the integration of physical and digital systems, the predominance of innovative business models and new processes, and the creation of smart products and services”*. Being aware of the definition assigned to digital transformation, we still wonder how digitized Europe is? Do EU Member States fully benefit from advanced technologies being able to compete with the great global powers?

Without a proper understanding of the extent to which our lives are digitized, the gaps that hinder our development process and the points where we excel in terms of digital transformation, we are unable to fully benefit from the possibilities that exist by counteracting the weak points. Thus, this article aims to give an overview of the evolution of Europe in terms of digitization, its global position from the perspective of digital transformation being considered. In addition, the future directions through which the EU intends to

improve its transition to a digital world will be highlighted, considering the main possibilities offered by ICT developments.

2. EU digital transformation

Measuring the digitization degree of a state can be an extremely difficult task, given the numerous issues that need to be considered. However, an analysis of the current state and evolution of EU's digital transformation becomes necessary in order to identify future action points. In the following, we propose a review of the main findings resulting from specialized studies providing significant results.

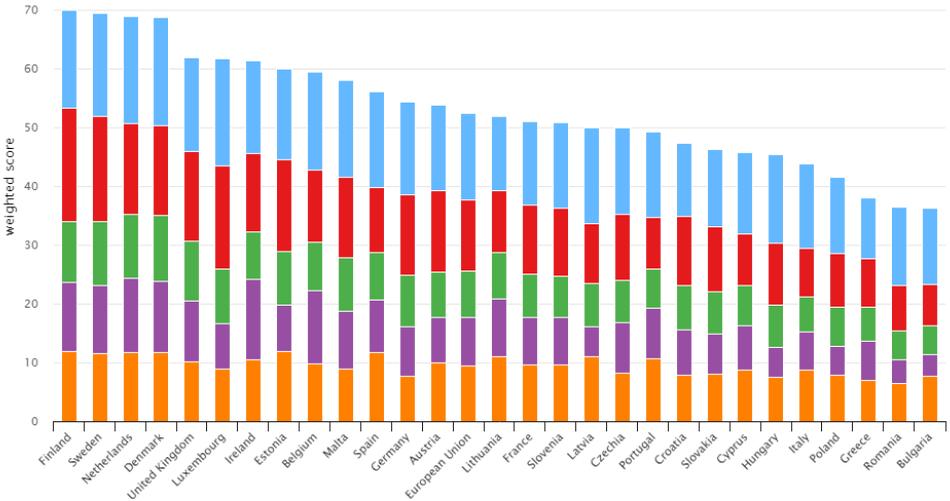
2.1 Measuring EU Digitization Level

One of the key methods used to determine the degree of digitization of Europe is the Digital Economy and Society Index (DESI). As a composite index, DESI synthesizes the main indicators related to Europe's digital performance, while also monitoring the evolution of EU Member States in terms of digital competitiveness. (European Commission, 2019)

The DESI index measures the digital performance recorded by the EU Member States in five dimensions or policy areas, as follows: *Connectivity* (25%), *Human Capital* (25%), *Use of Internet Services* (15%), *Integration of Digital Technology* (20%), *Digital Public Services* (15%). The overall DESI index is calculated as a weighted average of the five dimensions mentioned above. However, in order to provide a high degree of relevance, each dimension contains, in turn, specific sub-dimensions. (European Commission, 2019; Stoica & Bogoslov, 2018)

The values recorded so far for 2019 (Fig. 1) show us that Finland, Sweden, the Netherlands and Denmark reach the first four positions, having the most advanced digital economies. In fact, these are the four EU digital powers since 2014. The four countries are closely followed by United Kingdom, Luxembourg, Ireland, Estonia and Belgium. There is, however, the opposite extreme, made up of countries that are still working hard in terms of digital progress, with the lowest values this year being recorded by Poland, Greece, Romania and Bulgaria.

Figure 1. Digital Economy and Society Index by Main Dimensions of DESI (2019)



Source: European Commission, 2019 (European Commission, 2019)

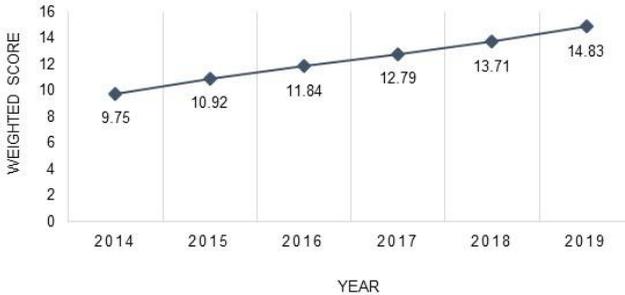
As observed, the countries under analysis have high values or low values for all five dimensions of the index. This highlights the fact that although it is possible for a country to excel or encounter problems only with respect to certain dimensions, low or high values are maintained for a state, in general, for all five dimensions, in contrast to its competitors.

2.2 EU Digital Evolution

Considering the purpose of the present paper, the considerations and records related to the digital evolution of the EU as a whole must be detailed. Fig. 1 exposed that the DESI index is calculated for each individual Member State and also for the EU as a whole. We intend to find out the overall EU digital evolution during 2014-2019, an interval analysed over time through DESI.

During 2014-2019, the largest increase recorded throughout the EU is related to connectivity, i.e. 52.14%, from a weighted score of 9.75 to 14.83, comparing between the reference periods 2014 and 2019 (Fig. 2).

Figure 2. Digital Economy and Society Index by Connectivity (2014-2019)

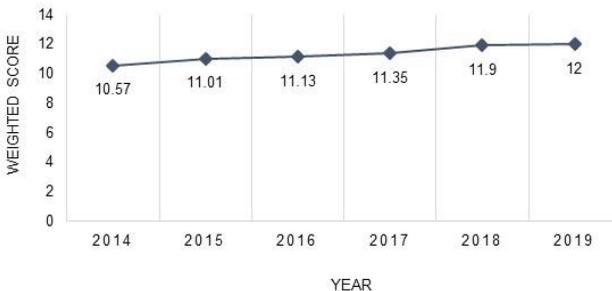


Source: Authors' sketching – Data from European Commission (European Commission, 2019)

When we look at connectivity, we note that it has recorded the highest annual weighted values in the last 3 years. Thus, we observe that, in terms of connectivity, the EU upon the whole maintains a constant upward trend when it comes to development.

Being at the opposite extreme, at the level of the whole EU digital progress in the period 2014-2019, Human Capital represents the part of the index that registered the smallest increase, of 13.52%, from a weighted score of 10.57 to the weighted score of 12.00 (Fig. 3). Although the annual values registered for the Human Capital dimension are promising, the ones recorded in 2014 and 2015 at EU level being the highest, in the last 3 years the growth has been slower compared to the other dimensions.

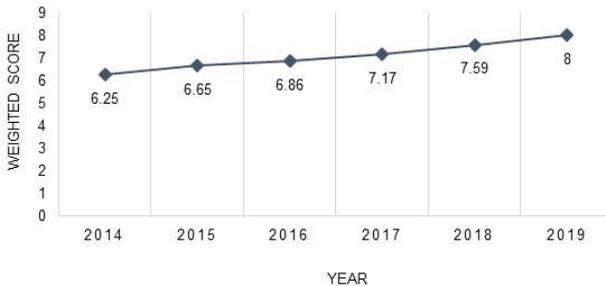
Figure 3. Digital Economy and Society Index by Human Capital (2014-2019)



Source: Authors' sketching – Data from European Commission (European Commission, 2019)

During years, the EU has not excelled in terms of Use of Internet (Fig.4), the values recorded for this dimension being the lowest in the reference period. Overall, the Use of internet indicator registered a value of 28% higher in 2019 than in 2014. However, at EU level, the annual value is still the lowest for the analyzed dimension.

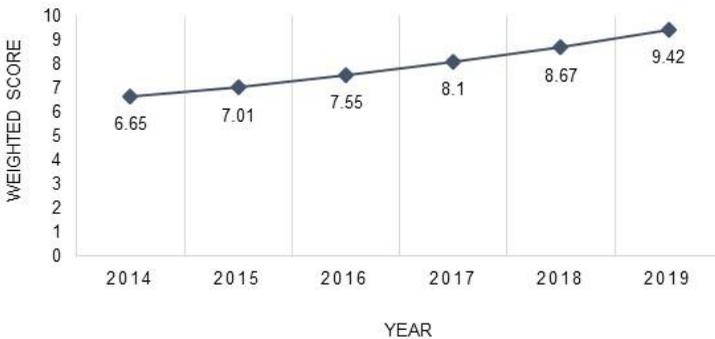
Figure 4. Digital Economy and Society Index by Use of Internet (2014-2019)



Source: Authors' sketching – Data from European Commission (European Commission, 2019)

With regard to Digital Public Services, the European Union has experienced a significant growth. Thus, at EU level, for the dimension in question, there was an increase of 41.65%, from 6.65 to 9.42 (Fig. 5).

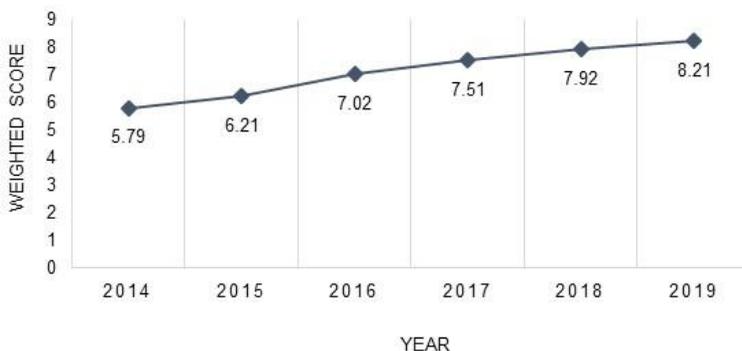
Figure 5. Digital Economy and Society Index by Digital Public Services (2014-2019)



Source: Authors' sketching – Data from European Commission (European Commission, 2019)

Although in 2014 and 2015 the dimension of Integration of Digital Technology (Fig. 6) registered the lowest values at EU level, compared to the other considered indicators, the annual growth registered until 2019 was quite high, the values approaching those obtained for Digital Public Services. Thus, in 2019 the EU obtained score with respect to the Integration of Digital Technology is 41.79% higher than the reference period 2014, which marks the considerable effort made by the EU Member States to overcome the initial gap.

Figure 6. Digital Economy and Society Index by Integration of Digital Technology (2014-2019)



Source: Authors' sketching – Data from European Commission (European Commission, 2019)

Considering the reference period 2014-2019, each of the 28 EU Member States has implemented policies and strategies to support the development of the digital economy and society. Of course, not all countries have managed to keep pace and evolve at the same rate. However, in relation to the progress of the European Union in terms of digitization, as a whole, increases have been registered for each dimension, without experiencing major annual fluctuations.

3. EU at Global Level

Over time, the digital transformation has led the Member States of the European Union to make considerable efforts in order to develop in digital terms, keeping up with the evolution of technology, the results presented above highlighting this aspect. In spite of the ongoing steps taken, in addition

to globalization, demographics and climate change, digitization is considered the fourth major challenge Europe is facing in medium term (European Commission, 2018). This leads to the need for immediate resolution measures. Thus, it becomes of great interest to compare the digital progress of Europe with non-EU countries whose development is undeniable.

In the absence of similar means of measuring the digital performance globally, comparison between the EU and non-EU countries would have been impossible. Thus, starting from the index already presented, i.e. DESI, the International Index for Digital Economy and Society (I-DESI) has been launched. The latter measures the digital progress recorded by the EU in average and by EU Member States compared to 17 non-EU countries.

The most recent study in this regard was carried out in 2018 (Fig. 7), 45 countries being analyzed, i.e. EU28 and 17 non-EU states. In this study, four-year data sets were used, from 2013 to 2016. Surely, in order to ensure the relevance of the analysis, measures such as correlation, covariance testing of indicators, sub-dimensions and dimensions were used, which made it an elaborate process. All of these were done in order to determine the matching degree between I-DESI and DESI data for 2013-2016 in relation to the five key dimensions. The level of correlation between I-DESI and DESI proved to be a good one, the correlation score registered being 0.94, given that a score of 1 indicates a "perfect match" and a zero score indicates no correlation. Therefore, the comparisons made can be considered as having a relatively high degree of confidence. (Foley, Sutton, Wiseman, Green, & Moore, 2018)

Figure 7. International Digital Economy and Society Index – I-DESI (2013-2016)



Source: Authors' sketching – Data from Foley, et al., 2018 (Foley, Sutton, Wiseman, Green, & Moore, 2018)

The digital performance of the EU28 compared to the other 17 states was evaluated within the study, comparing the average EU progress, the progress of the four digital EU leaders and the performance of the bottom four EU Member States. The results revealed that South Korea ranks first in global digitization, followed closely by the EU Top four countries. The EU as a whole ranked 11th in the ranking obtained, while EU Bottom four countries ranked 15th in the analyzed period.

Moreover, Denmark, part of the EU28, led the overall I-DESI ranking, registering a score of 75.9, over South Korea. In fact, Denmark was the leading country in DESI EU28 in 2015 and 2016. At the level of DESI EU28 Denmark has retained its position as leader in 2017. However, in the last 2 years, Denmark ranked 4th in terms of digital EU powers, after Finland, Sweden and the Netherlands, which may also cause a change in I-DESI for the period 2017-2019.

Therefore, we can say that EU countries rank on average in a favorable position compared to the other states under analysis. Although it performed at a good level, on average, the EU failed to cover the gap with nine analyzed states, including the US, South Korea and Japan.

4. Strengths and Weaknesses of EU Digital Performance

The breaking down to the five key dimensions of both DESI and I-DESI digital performance measurement methods highlights some of the strengths and weaknesses of Europe's digital performance. As mentioned, for I-DESI the data considered in the study presented above was only for a period prior to the year 2019. Thus, we will focus, in the initial phase, on the I-DESI findings on Digital Europe for 2016, this being the latest year in the analysis.

The development of a digital society is conditioned by the existence of a high quality digital infrastructure. In an era where activities tend to move from offline to online, high-speed Internet access at affordable prices represents a key factor for the advancement of the digital economy. In terms of connectivity, the EU28 on average performs relatively well compared to the other outside the EU countries analyzed.

Therefore, for the dimension whose purpose is to measure the deployment of broadband infrastructure and the quality offered by it, the average score obtained by the EU28 in 2016 was 62.9 (Foley, Sutton, Wiseman, Green, & Moore, 2018), ranking 7th. As the European Commission study shows, the EU28 performs better at broadband coverage take-up and broadband prices. However, EU28 development in terms of 4G coverage and mobile broadband usage is slower, making the Union surpassed by several non-EU countries.

In order to fully benefit from the possibilities offered by technology and the digital society as a whole, it is necessary for human capital to have skills and knowledge in the field of ICT. In this case, the EU on average performed less well compared to the score obtained for connectivity, occupying the 10th position in 2016, with a score of 58.

Of the two sub-dimensions analyzed in the case of Human Capital, ie Basic skills and Usage and Advanced Skills Development, it seems that the EU performs poorly in terms of the first one. Specifically, the Internet Use indicator within the Basic skills and Usage sub-dimension recorded quite low values for the EU28. Although the top four EU countries and the EU on average ranked relatively well compared to the other countries, only three non-EU countries scored lower than the bottom four EU Member States.

For the Use of Internet services by citizens dimension EU as a whole obtained good scores compared to the other 17 states. Thus, for 2016, the EU Member States average score for the Use of Internet Services by Citizens dimension was 59.7, ranking the 8th position.

Certainly, when talking about a digital economy, the digitization of businesses is extremely important. The dimension of Integration of Digital Technology by Business, in 2016, ranked the EU on average on the 10th position in comparison with the other analyzed states. The weak point of the EU considered in this regard is the use of Social Media instruments in businesses, with 12 countries registering a higher score than the EU on average.

With regard to Digital Public Services, we can state that this is the dimension for which the EU28 on average has performed poorly compared to the other non-EU countries. Although top four countries in the EU achieved scores close to the digital global leaders, the bottom four countries in the EU obtained the last position in the ranking, with a score of 41.1.

With an overview of the strengths and the EU's difficulties in terms of digital transformation in order to compete globally, we can focus on inner facts in this regard. Analyzing the data related to the digital evolution of the EU as a whole, as a result of calculating the DESI index, we observed that the EU recorded, during 2014-2019, the highest increase of the weighted score in terms of connectivity. If we refer to the period after 2016, year included in the calculation of I-DESI, the trend is maintained, the DESI index reporting the highest score for connectivity, with an increase of 25.28% for the period 2016-2019. These findings reveal the constant performance recorded by the EU in the evolution of the connectivity dimension and suggest a possible retention of the position compared to the global top.

Although, overall, the EU performs relatively well in terms of the Human Capital dimension compared with the non-EU states, it has recorded the slowest growth on an individual basis. Without any doubt, the progress is obvious, but the scores obtained for the period 2016-2019 by the DESI index indicate a very small increase compared to the other dimensions, of just 7.82%.

The weighted scores obtained by the EU as a whole for the Use of Internet and Integration of Digital Technology within DESI dimensions, show a relatively good growth compared to the other dimensions, both for the period 2014-2019 and for the period before 2016, until now. Thus, performing well

compared to the other non-EU states during 2013-2016, the EU tends to maintain itself through a constant further growth.

As mentioned above, the lowest score recorded by the EU compared to the other global digital powers was in the case of the Digital Public Services dimension. However, at the DESI level, the EU as a whole is making significant progress, the dimension in question recording the largest increase after connectivity, both in 2014-2019 and 2016-2019 (24.72% increase). Although the EU has a long way to go until it reaches the optimal level of Digital Public Services, we cannot dispute the efforts of the last years of the UE Member States.

We are thus at a point where we can say that the EU performed relatively well compared to the rest of the states outside the EU, but the gaps still exist. In fact, it is obvious that one of the main problems lies in the inconsistency of the so-called Digital Single Market. EU member states are progressing steadily, but the performance of the top four EU states can hardly replace the lack of digitization in the case of the other states, especially of the bottom four EU countries.

5. EU Digital Achievements and Future Potential

The attention of the European Commission has been intensely focused on the development and implementation of policies and strategies that will ensure the EU's position as global digital leader. In order to support the economic recovery at European level, to ensure a smart and sustainable development and with the desire to keep up with the development in the ICT field, the EU has elaborated the Europe 2020 Digital Agenda. The Digital Agenda represents one of the seven pillars of the Europe 2020 Strategy, its main objective being the development of a Digital Single Market.

In order to ensure transparency, fairness and safety, the European Commission laid the foundation of a strategy already known today, namely the Digital Single Market Strategy. The three basic pillars targeted are as follows: facilitating the access to digital goods and services throughout Europe among consumers and businesses, ensuring optimal conditions for the development of digital networks and services and maximizing the growth potential of the digital economy (Maciejewski & Gouardères, 2019). The pillars established within the strategy are meant to ensure the achievement of the proposed objective of creating the Digital Single Market by ensuring optimal conditions for digitization at European level.

According to previous findings, the existence of a Digital Single Market represents the key factor that would ensure that a leading global position of the EU in terms of the digitization level. However, we are close to the deadline set for the DSM Strategy. Thus, it is important to realize what was achieved in the strategy and what is proposed for the next period.

We have already noticed the improvement in terms of the digital performance of the EU as a whole, and the concrete results obtained from 2015 so far, both for EU citizens and for industry, mainly focus on the following (Negreiro & Madiega, 2019):

- Implementing measures to ensure the transformation of the digital industry, such as public-private partnerships.
- The application of measures or regulations for the purpose of digitizing the public sector. We can thus mention two important regulations that came into force from 2018, namely: the eIDAS regulation, which aims at cross-border recognition of electronic identification means and the Digital Single Gateway Regulation, which represents the online access point for the purpose of collecting information on national laws, procedures and administrative requirements.
- Revising the European electronic communications code in order to provide more rights to citizens, for example the right to receive public alerts on mobile phones in case of emergencies.
- Granting new broadband funds in order to support digital network infrastructure in disadvantaged areas.
- Elimination of roaming tariffs in 2017 ensuring communication without additional charges on EU territory.
- Offering an open Internet through which every European individual is guaranteed freedom in terms of content and services chosen.
- Improving the cybersecurity capabilities and cooperation, especially by adopting cybersecurity packages such as the Nis Directive or the Cybersecurity Act.
- Improving EU rules on cross-border online content.
- Adopting a law that facilitates EU access to high quality and more competitive processing services and data storage.
- Applying new rules to ensure the protection of personal data (GDPR).

- The elimination, to some extent, of geo-blocking.
- Review of the legislation on the re-use of public sector information (PSI) in order to encourage transparency, data-based innovation and fair competition.
- Modernization of EU copyright rules, which ensures broad online access, while protecting authors and artists with regard to the digital exploitation of their creations.

Although the results are important, it is necessary to ensure the continuity of Europe's progress from a digital point of view. This progress can only be achieved through a better and more efficient use of the unlimited opportunities offered by digital technologies. However, in order to eliminate the barriers encountered by certain states in this regard, major investments are needed.

In June 2018, the European Commission proposed the creation of the Digital Europe program (European Commission, 2019) which covers the period 2021-2027 and whose approval was made in the spring of 2019. This approach involves making investments worth EUR 9.2 billion to support the EU in the long term to meet the huge challenges in the digital field.

One of the main investment spheres aimed at the development of digital Europe refers to supercomputers, their development and use by EU Member States. In this regard, projects worth EUR 2.7 billion will be implemented in order to develop and consolidate high performance computing and data processing facilities in Europe. At the same time, artificial intelligence, a current and important trend in the ICT field, is aimed at development and use throughout the European economy and society.

The third investment objective refers to the financial support for ensuring the cyberspace security within the EU. The investments will be made for the supply of advanced equipment and infrastructure in the field of cybersecurity to the EU, as well as to ensure the development of the necessary skills and knowledge for individuals.

Also, investments in Human Capital are not to be neglected. The new directives will guarantee that the current and future workforce will be adequately trained by participating in training courses and on-the-job training courses with the aim of acquiring advanced digital skills.

In addition, the dimension for which the EU recorded less favourable results at global level will be in the focus of the European Commission strategy. Digital Public Services tends to step up in terms of digitization,

benefiting from EUR 1.3 billion investments. Thus, the digital transformation of public administration and public services and their interoperability in the European Union will be ensured.

Overall, the investments target the five main dimensions in digitization, the amounts being distributed according to the observed needs. With this interest of the responsible authorities, we can expect that the digital progress of the EU Member States will lead to positioning of the Digital Single Market as a global digital leader.

6. Conclusions

The European Union has been in a relatively good position from a digital point of view compared to the other non-EU countries, but it is still not in a leading position in terms of digitization at global level. Considering the aspects mentioned previously, we can draw the following main conclusions:

- The dimensions for which the EU performed well at the individual level are, for the most part, those for which it has held favourable positions compared to the rest of the non-EU states. This fact highlights the continuous efforts made by the EU Member States to develop and maintain their current position.
- Although at the DESI level, the EU as a whole registered the smallest increase in the case of Human Capital during the analyzed periods, it performs relatively well compared to the countries outside the EU. Thus, the low individual performance in terms of developing the skills and knowledge of individuals in the digital field could be considered not just an internal, at EU level, difficulty, but also, to some extent, a gap at global level.
- The dimension for which the EU recorded the lowest scores globally, ie Digital Public Services, benefited from one of the largest increases in the weighted average at the DESI level. It is clear that the efforts made to cover the gap between the EU and non-EU states in the case of digitizing public services are huge.

In line with key findings revealed by DESI 2019, EU Member States that have set their goals in line with the EU's Digital Single Market Strategy, supporting them through significant investments and have made better progress in a relatively short period of time. Therefore, in order for the EU to become a global digital leader, efforts must continue to be made by all Member States, but our opinion is that strong support is needed among the

countries from the last positions in the DESI and I-DESI scores, which are almost the same throughout the analyzed period.

This current article highlighted the main factors with respect to the digital Europe and the continuous efforts made by the Member States in this regard. Moreover, the study presented a comparative analysis between the results provided by two indexes, DESI and I-DESI, emphasizing the overall EU digital performance. The comparison made helps us to build an overall view, to better understand which are the EU concerns in terms of digital transformation and, consequently, which areas need more investment and development efforts.

As a future direction of the research in question, a more detailed analysis needs to be carried out, in order to identify potential decisive indicators for transforming the EU into a digital leader. Such an analysis could lead to the proposal of new dimensions necessary for a better development of the EU, but also for increasing the relevance of the analysis between the EU and non-EU states.

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