

*KATARZYNA ŻAK*

Uniwersytet Ekonomiczny w Katowicach<sup>1</sup>

### THE EVALUATION OF THE DIGITAL COMPETENCES OF POLAND AND POLISH ENTERPRISES IN THE CONCEPT OF THE MULTI-CRITERIA MEASUREMENT OF DIGITIZATION

#### Summary

The article presents the nature and role of digitization in the development of modern economies and societies. The idea of developing the digital society and economy in the European Union and its member states is supported by a number of documents, the most important being: the Digital Agenda for Europe and the Digital Single Market Strategy.

We conducted the evaluation of the digital competences of the Polish economy, including Polish enterprises, in comparison with other EU countries using the holistic methodology DESI (Digital Economy and Society Index).

**Keywords:** digitization, competences, measurement, the Digital Economy and Society Index (DESI).

#### Introduction

A modern digital economy has become a key factor in economic growth and competitiveness in the global reality. The digital evolution, unfolding before our eyes, has created the new model of a global economy, based on knowledge and innovation, where the skilful use of digital potential allows us to cross borders both in geographical and civilizational terms.

In the last two decades, Poland has implemented a number of important changes, economic and social reforms, which have allowed it to build a strong position among the European countries. The changes involved in the rapid development of the global digital economy, however, are posing new challenges for us. The dig-

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<sup>1</sup> Wydział Zarządzania, Katedra Zarządzania Przedsiębiorstwem.

itization of an increasing number of social processes boosts the significance of ICT competences. In order to prevent Poland from becoming an outsider among the European countries, we need to define these competences and initiate steps aiming to develop them. Openness to digitization, defined as improved access to high-speed Internet connections, reduced digital exclusion, and developing trust in digital technologies, creates new opportunities for citizens, consumers and employees (Report: *Cyfrowa przyszłość Polski*).

The article aims to discuss Poland's current performance in digital progress with particular emphasis on enterprises. The application of the DESI methodology (Digital Economy and Society Index) allows for the determination of the overall digitization index and the individual indices for Poland and other European Union countries and, as a results, offers an opportunity to form their ranking based on the indices.

## **1. Digitization – the priority of modern socio-economic development**

The growth of the digital economy and society is a fact. The digital sector is growing seven times as fast as the rest of the economy, yet its potential is hampered by the absence of the consistent European political framework. Europe is lagging behind other countries in the area of fast, reliable and connected digital networks, which are the foundation of the modern economy and a necessity in the daily life of people and businesses (Digital Agenda for Europe. Report 2014). In order to face the challenges of digital revolution, the Digital Agenda for Europe was launched in 2010 as one of the seven flagship initiatives in the development strategy "Europe 2020."

The rationale behind the agenda is the need to unleash potential to support innovation, economic growth and progress. In 2013, the European Union launched the Telecoms Single Market Strategy, which aims to bring Europe back as a world leader in the digital economy. Another document is the Digital Single Market Strategy, focusing on the digital economy and the removal of barriers in cross-border trade. This aims to make the European Union more competitive in the era of the digital economy. The Digital Single Market Strategy will be built on three pillars (A Digital Single Market Strategy for Europe):

- Better access for consumers and businesses to online goods and services across Europe – this requires the rapid removal of key differences between the online and offline worlds to break down barriers to cross-border online activity.
- Creating the right conditions for digital networks and services to flourish – this requires high-speed, secure and trustworthy infrastructures and content services, supported by the right regulatory conditions for innovation, investment, fair competition and a level playing field.

- Maximizing the growth potential of our European Digital Economy – this requires investment in ICT infrastructures and technologies such as Cloud computing and Big Data, and research and innovation to boost industrial competitiveness as well as better public services, inclusiveness and skills.

The Digital Single Market Strategy embraces 16 initiatives (grouped in three pillars) that will ultimately lead to the adoption of common European regulations (for example, in the area of data protection, telecommunications, copyright in the times of the digital revolution and changing consumer behaviour, as well as updated and simplified consumer protection rules for online and digital shopping) and the merger of 28 national markets into one European market.

It is estimated that, in the long term, the Digital Single Market may contribute to a GDP increase of approx. €20bn in the EU-28. Particular policies, for example the use of cloud computing, may ensure that 80 percent of organizations will be able to reduce costs from 10 percent to 20 percent. Other benefits include the growth in mobile work (46 percent), improved productivity (41 percent) and normalization (35 percent), enhanced business opportunities (33 percent) and new markets (32 percent) (Unleashing the Potential of Cloud Computing in Europe).

## 2. DESI – the concept of multi-dimensional measurement of digitization

The holistic approach to the measurement of digitization uses the tool developed in the European Union – the Digital Economy and Society Index, DESI [DESI 2015]. The DESI is composed of five principal dimensions, each divided into a set of sub-dimensions, which are in turn composed by individual indicators. The overall scheme of the index is presented in Table 1.

Table 1

The overall scheme of the Digital Economy and Society Index, DESI

Main Index	Principal Dimensions	Weight	Sub-dimensions	Weight
Digital Economy and Society Index, DESI	Connectivity	25%	Fixed Broadband	33%
			Mobile Broadband	22%
			Speed	33%
			Affordability	11%
	Human Capital	25%	Basic Skills and Usage	50%
			Advanced Skills and Development	50%
	Use of Internet	15%	Content	33%
			Communication	33%
			Transactions	33%
	Integration of Digital Technology	20%	Business digitization	60%
			e-Commerce	40%
	Digital Public Services	15%	e-Government	67%
			e-Health	33%

Source: elaboration based on DESI 2015, Digital Economy and Society Index.

The DESI methodology is based on the multidimensional weighted measurement of a particular phenomenon. It involves the determination of a number of criteria describing a studied phenomenon while taking into account different weights of particular dimensions, reflecting the subjective preferences of an evaluator (Nosál, 2001, p. 179). The application of weighted multidimensional measurement is justified by the fact that, in practice, different dimensions carry the same value extremely rarely (Cf. Szapiro, 1993, pp. 124-135, Gierszewska, Romanowska, 1996, p. 90; Stabryła, 2011, p. 238 and further).

In order to calculate the composite digital index (DESI), we use the total of 30 individual indicators, while the process of attributing weights occurs on two levels, i.e. for 13 sub-dimensions and five principal dimensions. The weights of principal dimensions reflect the EU's digital policy priorities. Both Connectivity and Human Capital are considered to be the fundamental pillars of the digital economy and society and they represent the infrastructure of the digital economy and society. Each of these two principal dimensions makes up 25 percent of DESI. In turn, Integration of Digital Technology accounts for 20 percent of the total value of the index, since the use of these technologies by the business sector is one of the most important growth drivers. The remaining two dimensions, Use of Internet and Digital Public Services were given the weight of 15 percent. Use of Internet and Digital Public Services are enabled by the infrastructure and their contribution is strengthened by the quality of such infrastructure. For this reason, they were weighed less.

The main DESI index as well as all its sub-indices may range from 0 to 1, 1 being the highest level of digitization. It is worthwhile to mention that due to the fact that the indicators are expressed in different units, they are normalized using the min-max method, which consists on a linear projection of each indicator onto a scale between 0 and 1 [DESI 2015, Methodological Note].

### **3. The DESI diagnosis for Poland in comparison with other European Union countries**

The DESI is a tool that provides a synthetic evaluation of the performance and progress of both individual countries and the entire European Community in terms of fulfilling major priorities embraced by the strategy of building the digital economy and society. Figure 1 shows the DESI indices reflecting the performance of the 28 EU countries.

The comparison of the digitization index reveals three basic group of countries:

- High performance group – comprising Denmark, Sweden, Finland and the Netherlands. They are not only ahead in the UE-28, but they are also world leaders in digital. In Europe, Norway and Iceland also belong to this group.

- Medium performance group – which includes: Belgium, the United Kingdom, Estonia, Luxemburg, Ireland, Germany, Lithuania, Spain, Austria, France, Malta, Portugal. They are doing well in certain areas but still need to progress in others.
- Low performance group includes: the Czech Republic, Latvia, Slovenia, Hungary, Slovakia, Cyprus, Poland, Croatia, Italy, Greece, Bulgaria, Romania. They need to step up their performance in a number of areas and catch up with the rest of the UE-28.

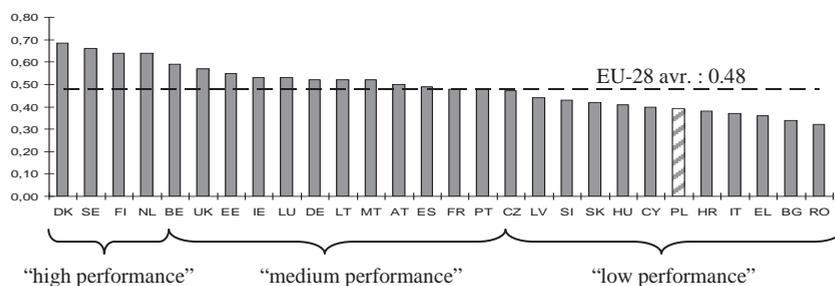


Fig. 1. DESI scores in the EU-28, 2015

Source: elaboration based on DESI 2015, Digital Economy and Society Index.

In 2015, Poland ranked the 23<sup>rd</sup> in the European Union in terms of the digitization index (0,39), while in 2014 it held the 24<sup>th</sup> position with 0,36. The low level of the DESI index puts Poland in the low performance group of countries. In 2015, in all five principal dimension Poland performed worse not only than the leaders, but also the EU average (Figure 2).

In terms of Connectivity, Poland ranked the 21<sup>st</sup> among the EU member states both in 2014 and 2015. Also, with the score of 0,43 in Human Capital, Poland remained on the 22<sup>nd</sup> position in the EU ranking, although the score was marginally better than in 2014 (0,41). Poland's score on Use of Internet was 0,36, higher by 0,03 than in 2014, which raised the country to the 23<sup>rd</sup> position (24<sup>th</sup> in 2014).

With regard to Integration Digital Technology, Poland scored 0,21 (compared with 0,19 in 2014) and was ranked the 26<sup>th</sup>. Despite a slight increase, it is the weakest score that Poland achieved both in terms of the score itself and the position it held among the EU countries. In the last principal dimension – Digital Public Services – Poland scored 0,43 and ranked the 14<sup>th</sup> in the year 2015 (compared with the 15<sup>th</sup> position in 2014). It is Poland's best score and highest position in the EU ranking.

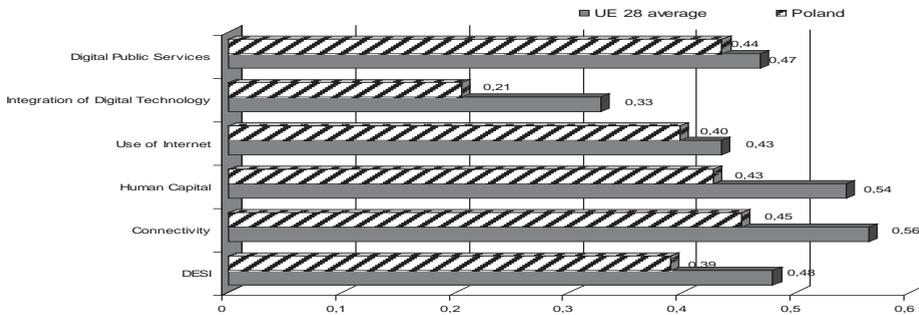


Fig. 2. DESI scores in Poland against the EU-28 average, 2015

Source: elaboration based on DESI 2015, Digital Economy and Society Index.

#### 4. Digital competences of Polish enterprises

Polish enterprises are going digital slowly, which is revealed in their DESI scores, as both sub-dimensions and individual indicators place them significantly below the EU average.

In terms of Integration of Digital Technology, Poland ranks the 26<sup>th</sup>, performing better than only Romania and Latvia (Figure 3).

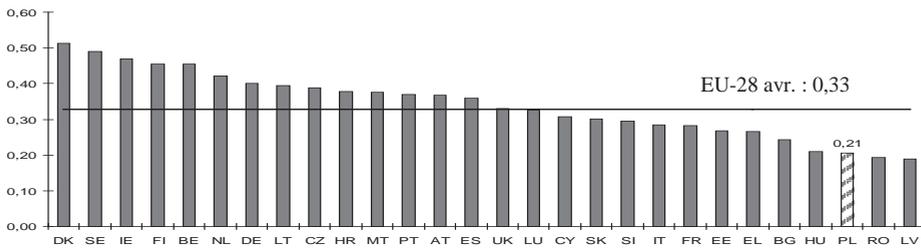


Fig. 3. Integration of Digital Technology scores in the EU-28, 2015

Source: elaboration based on DESI 2015, Digital Economy and Society Index.

Integration of Digital Technology is measured through the prism of two sub-dimensions, composed of individual indicators:

1. Business digitization, comprising the individual indicators: Electronic Information Sharing, RFID (Radio-frequency Identification Technologies), Social Media, e-Invoices, Cloud;
2. e-Commerce, comprising the individual indicators: SMEs Selling Online, e-Commerce Turnover and Selling Online Cross-border.

Notably, with regard to Business digitization Poland ranked the 26<sup>th</sup> among the EU member states in 2014 (0,194) and 2015 (0,202), in 2014 performing better

than Hungary and Romania and in 2015 – better than Hungary and Latvia. The country had a better position in the dimension of e-Commerce. In 2014 Poland ranked the 24<sup>th</sup> (0,204), outperforming Greece, Romania, Italy and Bulgaria, while in 2015 it moved up to the 23<sup>rd</sup> position (0,213), doing better than Latvia, Greece, Romania, Italy and Bulgaria.

While analyzing individual indicators, forming the sub-dimension of Integration of Digital Technology, it can be observed that all the scores for Poland are considerably lower than the EU-28 average both in 2014 and 2015 (Figure 4).

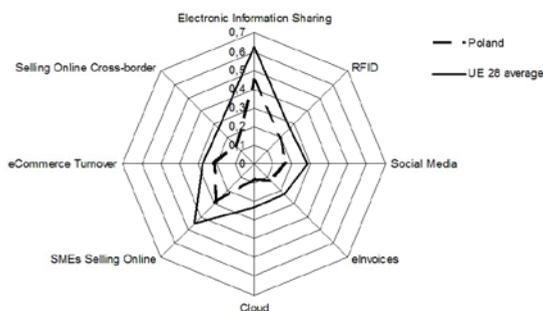


Fig. 4. Scores on individual indicators in the sub-dimension of Integration of Digital Technology in Poland as compared with the EU average, 2015

Source: elaboration based on DESI 2015, Digital Economy and Society Index.

Compared to other EU countries, particularly low scores were achieved for the indicators of Cloud (27<sup>th</sup> position) and Selling Online Cross-border (27<sup>th</sup> position). Positive change in 2015 involves an increase in the number of enterprises sharing information electronically, using social media and selling online compared with 2014.

Nevertheless, in order to catch up with their European competitors and take full advantage of the potential offered by digital technologies with regard to productivity, Polish enterprises should embrace digitization processes more comprehensively.

## Conclusion

Undoubtedly, digital technologies already play and will continue to play an increasingly important role in the socio-economic development of both national economies and entire politico-economic unions, such as the European Union. The initiatives aiming to unleash broadly understood digital potential and pursued in a pro-active and consistent manner should contribute to the modernization of the social model and development, the promotion of digital tools as the way to improve

employment flexibility in enterprises, and the creation of positive prospects in private and professional lives.

The figures and charts presented in the article allow for the formulation of the following conclusions:

- The use of digital technologies varies greatly in the European Union countries, with the digitization index ranging from 0,68 for such countries as Denmark (on the 0–1 scale) to 0,31 for Romania, which is representative of low performing countries.
- Denmark, Sweden, Finland and the Netherlands are the countries leading in the EU-28 in terms of the index of the digital economy and society (DESI). The underperformers are Romania, Bulgaria and Greece.
- Poland ranked the sixth lowest among the 28 EU member states in terms of the DESI index. This position places Poland in the low performance group, which comprises the countries performing below average in the DESI ranking and without strong potential – their annual growth in the DESI index is lower than the average growth in the European Union.
- The figures show that in the five principal dimensions, i.e. Connectivity, Human Capital, Use of Internet, Integration Digital Technology, and Digital Public Services, Poland achieved lower values of the indexes than the average values achieved in the EU-28. The most significant differences concern Integration Digital Technology, Human Capital, and Connectivity. Compared to the average EU-28 performs, Poland performs relatively well in the areas of Use of Internet and Digital Public Services.
- The level of digitization in Polish enterprises, expressed with the DESI index, is very low. The Integration Digital Technology Index is the weakest result achieved by Poland both in terms of the value and in terms of the position in the UE-28 DESI ranking. In order to take advantage of the potential locked in digital technologies, Polish entrepreneurs would have to make better use of cloud computing, exchange information digitally, apply social media to building customer relations, and stimulate online sales, both domestically and internationally.

The synthetic presentation of the Digital Economy and Society Index clearly shows that Europe is on its way to the digital future. Poland's performance in digital (2014–2015) compared to other European Union countries, however, is not impressive. Definitely, Poland's aspirations in this area are considerably more ambitious, but failed efforts will lead to the slowdown in socio-economic development and a longer distance to catch up with the more digital EU economies.

If Poland is to make better use of the potential locked in digital solutions, it has to receive support from different institutions at national and EU levels. Moreover, it has to commit substantial funding and build trust in the digital economy among its citizens and businesses.

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## OCENA CYFROWYCH KOMPETENCJI POLSKI I POLSKICH PRZEDSIĘBIORSTW W KONCEPCJI WIELOKRYTERIALNEGO POMIARU CYFRYZACJI

### Streszczenie

W artykule zaprezentowano istotę i rolę cyfryzacji w rozwoju współczesnych gospodarek i społeczeństw. Idea rozwoju społeczeństwa i gospodarki cyfrowej w Unii Europejskiej i jej krajach członkowskich jest wspierana szeregiem dokumentów, wśród których wiodącą rolę pełnią: „Europejska Agenda Cyfrowa” i „The Digital Single Market Strategy”. Oceny cyfrowych kompetencji polskiej gospodarki, w tym polskich przedsiębiorstw, na tle krajów Unii Europejskiej dokonano wykorzystując holistyczną metodologię DESI (*Digital Economy and Society Index*).

**Słowa kluczowe:** cyfryzacja, kompetencje, pomiar, wskaźnik gospodarki cyfrowej i społeczeństwa cyfrowego (DESI).

*Tłumaczenie Katarzyna Żak*