DOI 10.2478/vjes-2023-0003

Integration of Digital Technology in Enterprises

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Abstract

This study analyzes the main indicators regarding integrating digital technology in enterprises, in the context of sustainable digital transformation in the European Union (EU). The purpose of this analysis is to group indicators into three levels of importance. Thus, using the semaphore technique, the indicators will be delimited by three colors: green, yellow, and red. Depending on the three colors, future measures will be taken and strategies will be established regarding the indicators thus delimited. This research methodology is based on comparative analysis and case studies.

Keywords: *Indicators, Analyze, Digital Technology, Enterprises.*

JEL Classification: M21, M16.

Introduction

In the context of sustainable digital transformation in the EU, this study brings to the fore a pertinent analysis of some indicators that we consider very important. In the political program called *The road to the Digital Decade: 2020-2023*, the European Commission sets concrete and measurable objectives for the digital transformation. One of the key areas of Europe's Digital Decade is the digital transformation of enterprises, an area in which some EU countries, such as Romania, have significant gaps. It is thus justified to carry out the case study on the example of Romania, specifying that the analysis can be done in the case of any other country or even at the EU level. A useful tool in this research is provided by the European Commission's Digital Economy and Society Index (DESI) reports. The European Commission has monitored, since 2014, Member States progress in digital and published reports DESI - Digital Economy and Society Index. The country reports combine quantitative data from the DESI indicators for the four dimensions of the index (Human capital, Connectivity, Integration of digital technology, and Digital public service) with observations on country-specific policies and good practices.

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These country profiles help Member States to identify areas for priority action. The DESI Index analyzes the progress made by Member States over the past five years, ranking them according to their level of digitalization.

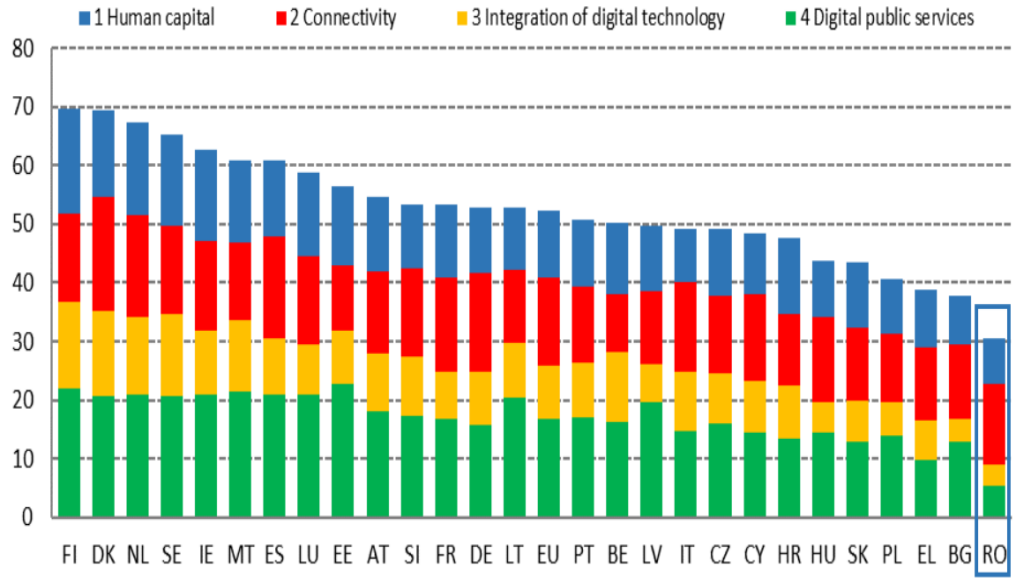
It is also important to specify that among the DESI 2022 indicators, 11 are even targets set in the Digital Decade at the European level.

1. Digital Economy and Society Index for 2022 in the European Union

Figure 1 shows the DESI Index which ranks EU Member States according to their level of digitalization in 2022 for the four dimensions: Human capital, Connectivity, Integration of digital technology, Digital public service.

Figure 1.

Digital Economy and Society Index (DESI) 2022 ranking



(Source: European Commission, DESI 2022)

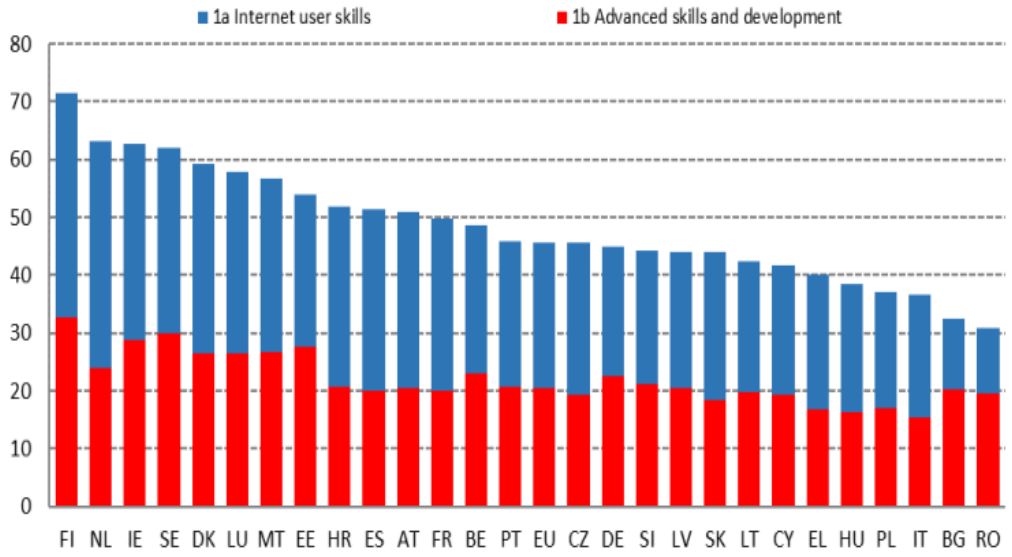
It is easy to see that, in the 2022 edition of the Digital Economy and Society Index, Romania is at the bottom of the EU, ranking 27th out 27 EU Member States, with a score of 30.6 compared to the EU score which is 52.3.

The analysis carried out within DESI 2022 reveals the fact that Romania „is lagging behind for several indicators in the human capital dimension, with a very low level of basic digital skills compared to the EU average, but maintaining its high rankings in the proportion of female ICT specialists in employment (ranking 2nd) and ICT graduates (ranking 4th)" [European Commission, 2022].

Also, within the same analysis it is revealed that „Romania performs comparatively well on connectivity, which is the dimension where it scores best. The take-up of at least 100 Mbps fixed broadband (57%) and fixed very high-capacity networks coverage (87%) surpasses the EU average" [European Commission, 2022].

Figure 2.

Digital Economy and Society Index (DESI) 2022, Human capital

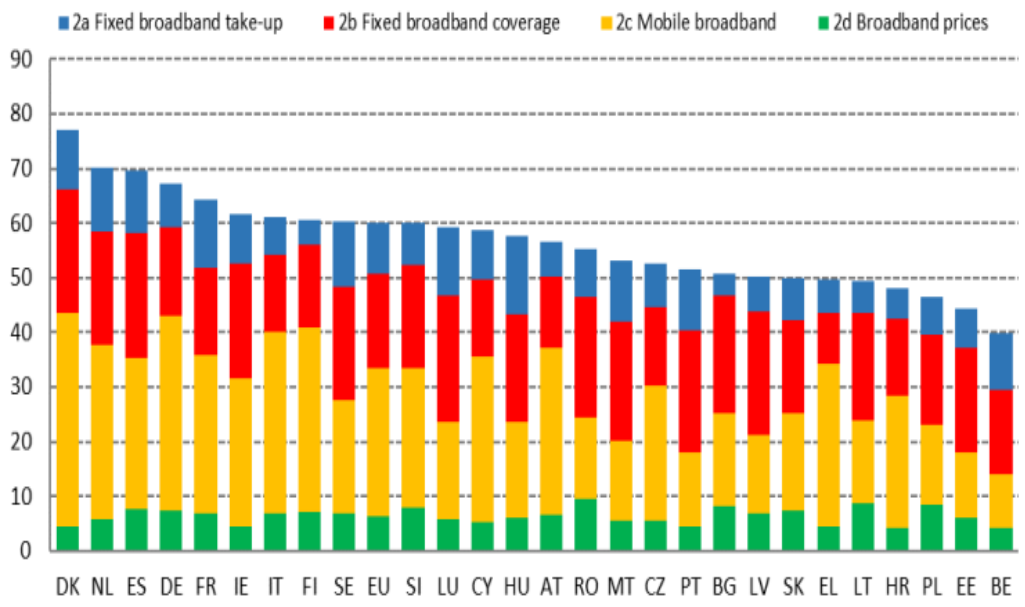


(Source: European Commission, DESI 2022)

For the four dimensions of DESI indicators, the situation is presented in figure 2 (Human capital), figure 3 (Connectivity), figure 4 (Integration of digital technology) and figure 5 (Digital public service).

Figure 3.

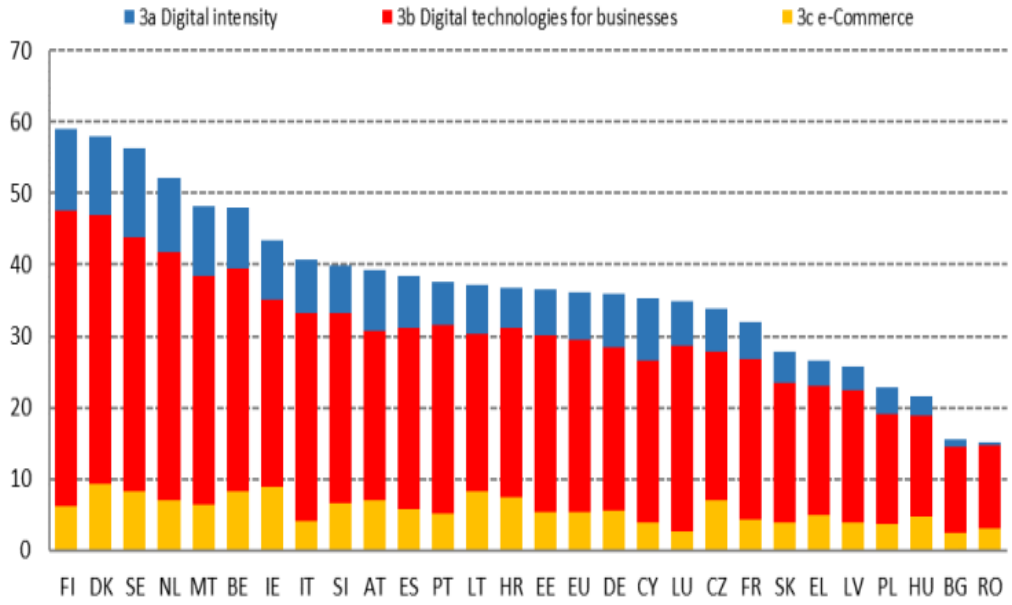
Digital Economy and Society Index (DESI) 2022, Connectivity



(Source: European Commission, DESI 2022)

Figure 4.

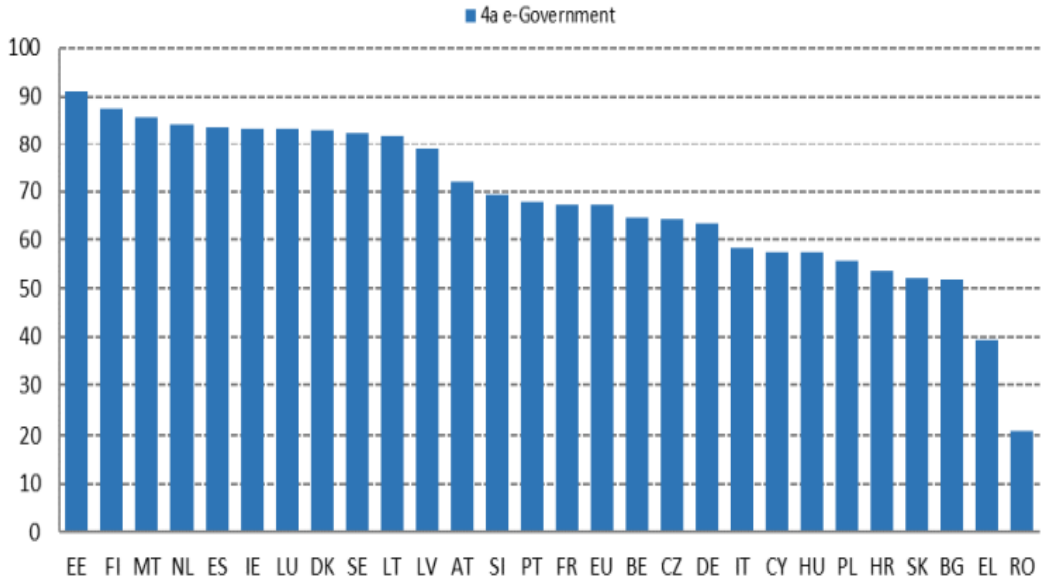
Digital Economy and Society Index (DESI) 2022, Integration of digital technology



(Source: European Commission, DESI 2022)

Figure 5.

Digital Economy and Society Index (DESI) 2022, Digital public service



(Source: European Commission, DESI 2022)

It can be observed that for all the four dimensions of the DESI indicators, Romania ranks last among the EU member states. This fact, which can only be worrying, leads to the immediate need for concrete and sustainable measures, in order to improve the situation.

2. Analysis of the indicator Integration of digital technology

Regarding the synthetic indicator Integration of digital technology, according to the DESI 2022 report developed by the European Commission (Table 1), Romania had a score of 15.2, compared to the EU average score of 36.1.

It can be interpreted that Romania ranks less than half of the EU average, being in the last place among the EU member states.

Table 1.

Integration of digital technology (2022): score Romania vs. EU

INDICATOR	EUROPEAN UNION (EU)	ROMANIA (RO	
	Score	Score	Rank
Integration of digital technology (DESI 2022)	36.1	15.2	27

(Source: European Commission, DESI 2022)

In addition to Table 1, Table 2 presents in detail the values of the components of the Integration of digital technology indicator for Romania, in the period 2020-2022, and the average of the indicators at EU level in 2022.

Analyzing the component of the indicators, we have several observations regarding their evolution in the period 2020-2022 and the comparison with the EU level in 2022.

Regarding the evolution of the indicators, we notice that we generally have an unfavorable trend.

In the analyzed period, it was registered a decrease for the following indicators: *Electronic information sharing, Big data, e-Invoices* and *Selling online cross-border*.

We have a fluctuating variation of increase followed by decrease in the case of the indicators: *SMEs selling online* and *e-Commerce turnover*.

We find only one indicator that registered growth during the analyzed period (*Social media*) and only one indicator that remained constant (*ICT for environmental sustainability*).

For three of the indicators (*SMEs with at least a basic level of digital intensity*, *Cloud* and *AI*) we do not have information available for the entire period, so the analysis of their evolution cannot be done.

Regarding the comparison with the EU average, only one indicator, namely *ICT for environmental sustainability*, recorded a value higher than the EU average (68% vs. 66%) and another indicator (*SMEs selling online*) that has a value close to this average (12% vs. 18%).

We notice that the *Cloud* and *AI* indicators register very low values compared to the EU average.

Table 2.

Integration of digital technology: Romania vs. EU

INDICATORS	EU DESI 2022	ROMANIA		
		DESI 2020	DESI 2021	DESI 2022
a1. SMEs with at least a basic level of digital intensity (% SMEs)	55%	NA	NA	22%
b1. Electronic information sharing (% enterprises)	38%	23%	23%	17%
b2. Social media (% enterprises)	29%	8%	8%	12%
b3. Big data (% enterprises)	14%	11%	5%	5%
b4. Cloud (% enterprises)	34%	NA	NA	11%
b5. AI (% enterprises)	8%	NA	NA	1%
b6. ICT for environmental sustainability (% enterprises having medium/high intensity of green action through ICT)	66%	NA	68%	68%
b7. e-Invoices (% enterprises)	32%	20%	17%	17%
c1. SMEs selling online (% SMEs)	18%	11%	17%	12%
c2. e-Commerce turnover (% SME turnover)	12%	5%	8%	7%
c3. Selling online cross-border (% SMEs)	9%	6%	6%	4%

(Source: European Commission, DESI 2022)

3. Applying the semaphore technique for the Integration of digital technology indicator

For the implementation of the semaphore technique, we make a few clarifications.

Thus, we will calculate the relative deviation of the indicator values from the EU average, using the following formula (1):

$$\text{Relative deviation} = \frac{\text{Indicator value} - \text{EU average}}{\text{EU average}} \text{x}100 \qquad (1)$$

Then, we will delimit 3 areas of significance that we will associate with the three colors similar to those of traffic lights. The red color will correspond to a negative deviation from 100% to 67% inclusive, the yellow color corresponds to a negative deviation from 66% to 34% inclusive, and the green color corresponds to a negative deviation less than 33%. Obviously, the green color will correspond to any positive deviation from the EU average value.

The results obtained for relative deviation Romania vs. EU in 2022, following the calculations, are shown in Table 3.

Table 3.

Integration of digital technology: the relative deviation Romania vs. EU

INDICATORS	EU DESI 2022	Romania DESI 2022	Relative deviation Romania vs. EU
a1. SMEs with at least a basic level of digital intensity (% SMEs)	55%	22%	-60%
b1. Electronic information sharing (% enterprises)	38%	17%	-55%
b2. Social media (% enterprises)	29%	12%	-59%
b3. Big data (% enterprises)	14%	5%	-64%
b4. Cloud (% enterprises)	34%	11%	-68%
b5. AI (% enterprises)	8%	1%	-88%
b6. ICT for environmental sustainability (% enterprises having medium/high intensity of green action through ICT)	66%	68%	+3%
b7. e-Invoices (% enterprises)	32%	17%	-47%
c1. SMEs selling online (% SMEs)	18%	12%	-33%
c2. e-Commerce turnover (% SME turnover)	12%	7%	-42%
c3. Selling online cross-border (% SMEs)	9%	4%	-56%

(Source: European Commission, authors processing)

The results of the semaphore technique for the Integration of digital technology indicator are presented in table 4.

Table 4.

Integration of digital technology Romania 2022: semaphore technique

INDICATORS	Areas of significance	Actions
b4. Cloud (% enterprises); b5. AI (% enterprises).	-100 ÷ -67%	Important short-term improvement measures
a1. SMEs with at least a basic level of digital intensity (% SMEs); b1. Electronic information sharing (% enterprises); b2. Social media (% enterprises); b3. Big data (% enterprises); b7. e-Invoices (% enterprises); c2.	-66% ÷ -34%	Medium term amelioration measures

e-Commerce turnover (% SME turnover); c3. Selling online cross-border (% SMEs).		
c1. SMEs selling online (% SMEs); b6. ICT for environmental sustainability (% enterprises having medium/high intensity of green action through ICT).	-33% ÷ 0% > 0%	Actions to maintain advantage

(Source: authors processing)

Conclusion

The final conclusion refers to the fact that the study presents an easier comparative analysis of the indicators, giving the possibility of guiding decisions according to their level of achievement. For future research, in order to deepen the knowledge of the real level registered by a country, we propose to supplement the synthesis indicators included in the DESI with other relevant indicators reported at the EU level. The knowledge and analysis of all these indicators can ensure a correct orientation of national strategies in the field of digitization, in general, and the integration of digital technology in enterprises, in particular.

References

European Commission (2022), *Shaping Europe's digital future,* available online at https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2022, accessed on 03.04.2023.

European Commission (2022), *Digital Economy and Society Index (DESI) 2022*, available online at https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2022, accessed on 03.04.2023.

European Commission (2022), *Digital Economy and Society Index (DESI) 2022 Romania*, available online https://ec.europa.eu/newsroom/dae/redirection/document/88717, accessed on 04.04.2023.

European Commission (2022), *Digital Economy and Society Index (DESI) 2022, Integration of digital technology*, available online at https://ec.europa.eu/newsroom/dae/redirection/document/88767, accessed on 04.04.2023.

OECD (2015), *Data-Driven Innovation: Big Data for Growth and Well-Being*, OECD Publishing, Paris, available online at https://doi.org/10.1787/9789264229358-en, accessed on 05.04.2023.