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Article

Analytical view on advancement of digital skills among EU consumers in electronic commerce

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Abstract: The development of digital technologies and their popularity in e-commerce is undeniable. However, consumers need to have a certain level of digital skills. The main aim of the paper was to examine and evaluate the development of consumers' digital skills in the European Union and to identify the potential significant impact on online shopping. The EU countries studied experienced an increasing trend in both internet users and online consumers over the period under review, with Romania and Estonia experiencing the most significant year-on-year increases in internet users and online consumers respectively. The trend of consumers with digital skills was volatile and in some EU countries it was decreasing year-on-year. When comparing the share of online consumers and the share of consumers with digital skills, it was not possible to generalize the results as in some countries the values were at comparable levels, but in selected countries the share of consumers with digital skills was higher than the share of online consumers and in other countries the opposite was true. The results showed the existence of a significant impact of the level of digital skills on online shopping and also of the use of the internet for online shopping. The results obtained can provide a basis for online retailers to promote the increase of consumers' digital skills, which will ultimately lead to the growth of e-commerce.

Keywords: online shopping; internet; e-commerce; online consumer; digital skills

1. Introduction

Digital technologies are increasingly permeating the modern lives of consumers, who have come to see them as an integral part of every day (Brodie et al., 2019; Ferreira et al., 2020). Digital technologies are evolving and changing at a rapid pace, and are increasingly permeating broader areas of the economy and society. The relationship between buyers and sellers is also changing, and is increasingly being transferred to the online environment of the internet. In a broader context, digital technologies are seen as an important catalyst for sustainable economic growth. Countries and their consumers and entrepreneurs need to be able to learn and adapt in order to keep pace with technological developments and thus benefit from digital technologies. Their adoption, use, and so-called digital transformation require increasing consumers' digital literacy and subsequently promoting the adoption and use of e-commerce, which contributes greatly to the development of the digital economy (Gonzalez et al., 2017; Kiseľáková et al., 2022). Digital transformation has been defined as a tool to change existing business processes, improving customer experience and value for businesses. This can be achieved precisely due to the advancement of digital technologies. Businesses can optimize existing business processes, achieve efficient coordination between them and also create value for

customers by improving user experience (Androniceanu and Georgescu 2023; Nagy and Valaskova, 2023; Pagani and Pardo, 2017; Ramaswamy and Ozcan, 2016).

The growing popularity of the Internet has been particularly evident in the business environment. The rapid development and progress of information and communication technologies has led to the digitalization and digital transformation of several processes, resulting in the necessity to redesign the way business processes are implemented and operate. The reason for these facts is demanding customers, which are prompting companies to invest more in online shopping platforms to be able to best meet their needs (Ritter and Pedersen, 2020). The result has been a radical change in the way businesses are managed and the emergence of new business models, with technology becoming a major driver of digital transformation and business growth. One of the most popular business models is e-commerce. It is a revolutionary change that is driven by innovative internet technologies. It is now a phenomenon that largely competes with traditional commerce due to its unique features and benefits (Faqih, 2022). E-commerce is considered the final manifestation of digital transformation, where businesses go beyond using digital as a form of internet presence, and move towards digitizing their sales functions and their supply chain integration process (Härting et al., 2017).

E-commerce has grown in parallel with the advancement of technology, as more and more people have started to use digital platforms as a specific market. Online shopping activities include searching for products or services, visiting online retail stores or websites, selecting products or services, and making online purchases through various digital devices such as laptops, desktops, or mobile phones (Jiang et al., 2021). E-commerce refers to conducting business transactions digitally or using the Internet. E-commerce provides an opportunity for businesses to grow and prosper, and has been shown to contribute positively to economic growth, regardless of a country's level of development (Kabir et al., 2020; Koe and Sakir 2020; Myovella et al., 2020). It is the buying, selling or exchanging of products and services through networks such as the internet, where transactions are carried out electronically on various digital devices such as smartphones, tablets and computers (Faqih and Jaradat, 2015; García, 2014; Horváth and Vojtechovský, 2023; Jalilvand and Samiei, 2012; Tavera and Londoño, 2014).

During the COVID-19 pandemic, the e-commerce sector grew as many consumers were forced to move their activities to the online space to obtain products or services without physical contact with the outside world. Thus, consumers increasingly shopped online, either due to government restrictions or of their own volition with the intention of eliminating social contact (Abdelrhim and Elsayed, 2020; Bhatti et al., 2020; Muangmee et al., 2021a; Muangmee et al., 2021b; Veselovska et al., 2023). The pandemic has also forced consumers to incorporate Internet technologies into their daily lives and use them beyond their normal usage. Despite the fact that the pandemic is no longer ongoing to the extent it is now, and restrictions have been lifted, it can be expected that consumer interaction with e-commerce will continue to increase in the coming years, but probably at a more moderate pace (Abiad et al., 2020; Ariansyah et al., 2021).

The biggest challenge to the adoption and use of e-commerce and digital technologies in different countries is infrastructure barriers, which include

underdeveloped telecommunications, i.e., poor network quality, slow internet speeds, broadband internet costs or poor access to internet connectivity. Barriers can also include consumers' subjective perception of risk, where different levels of perception of e-commerce security are noted. Lack of education and low levels of digital, technological or internet skills are also significant barriers to the development of e-commerce (Alyoubi, 2015; Mthembu et al., 2018; UNCTAD, 2019). Digital literacy skills include the knowledge, skills, and attitudes to use digital technologies and smart devices such as smartphones, tablets, laptops, and computers to collaborate, communicate, support and share. Developing these skills and raising awareness of the benefits associated with e-commerce can translate into effective use of technology in everyday personal and professional life (Polizzi, 2020; Tejedor et al., 2020). Consumers possess different levels of digital skills, depending for example on their socio-demographic characteristics, personality traits and experiences. However, based on the results of previous studies, it can be argued that consumers with higher levels of internet skills are able to use digital resources more effectively and engage in more internet activities, whether it is to communicate, to search and use information on the internet, or to make online purchases and transactions. Studies have also pointed to the level of digital skills as a significant predictor of internet use and also e-commerce (Burin et al., 2018; Deursen and van Dijk, 2016; La Torre et al., 2020; Mota and Cilento, 2020; Scheerder et al., 2017).

2. Materials and methods

The main aim of the paper is to examine and evaluate the evolution of consumers' digital skills and internet usage in the European Union and to identify potential significant impacts on online shopping. To delve into the subject matter, this paper sets out to answer 5 research questions:

- RQ1: What differences can be observed in the development of online shopping in EU countries during the period under review?
- RQ2: What differences can be observed in the development of the level of digital skills of consumers in EU countries during the period under review?
- RQ3: What differences can be observed in internet use across EU countries during the period under review?
- RQ4: Is there a significant impact of consumers' digital skill level on online shopping?
- RQ5: Is there a significant impact of internet usage on online shopping?

Based on previous research studies and the research questions identified, the following research hypotheses were formulated:

- RH1: We hypothesize that there is a statistically significant effect of consumers' level of digital skills on online shopping.
- RH2: We hypothesize that there is a statistically significant effect of Internet usage on online shopping.

To provide answers to these research questions and to verify research hypotheses, the study relies on secondary data analysis. The data used in the analysis were obtained from the database of the Statistical Office of the European Communities (Eurostat, 2023). Data covers the years 2011 to 2021. The research

sample consists of Internet users aged 16 to 74 who have made at least one online purchase in the previous 3 months. The unit of measurement is "percentage of individuals". The first variable is the proportion of consumers making online purchases and the second variable is the proportion of consumers with a certain level of digital skills (namely sharing, sending, and transferring files on the internet, i.e., working in an internet environment) and the third variable is the proportion of internet users. The data collected was visually analyzed using the RStudio software. The regression analysis for verifying hypotheses was also conducted using the RStudio software.

3. Results and discussion

The data acquired from the Eurostat database, along with its visualization, allows for the evaluation and comparison of the growth of online shopping, digital skills of consumers and internet use in the EU countries.

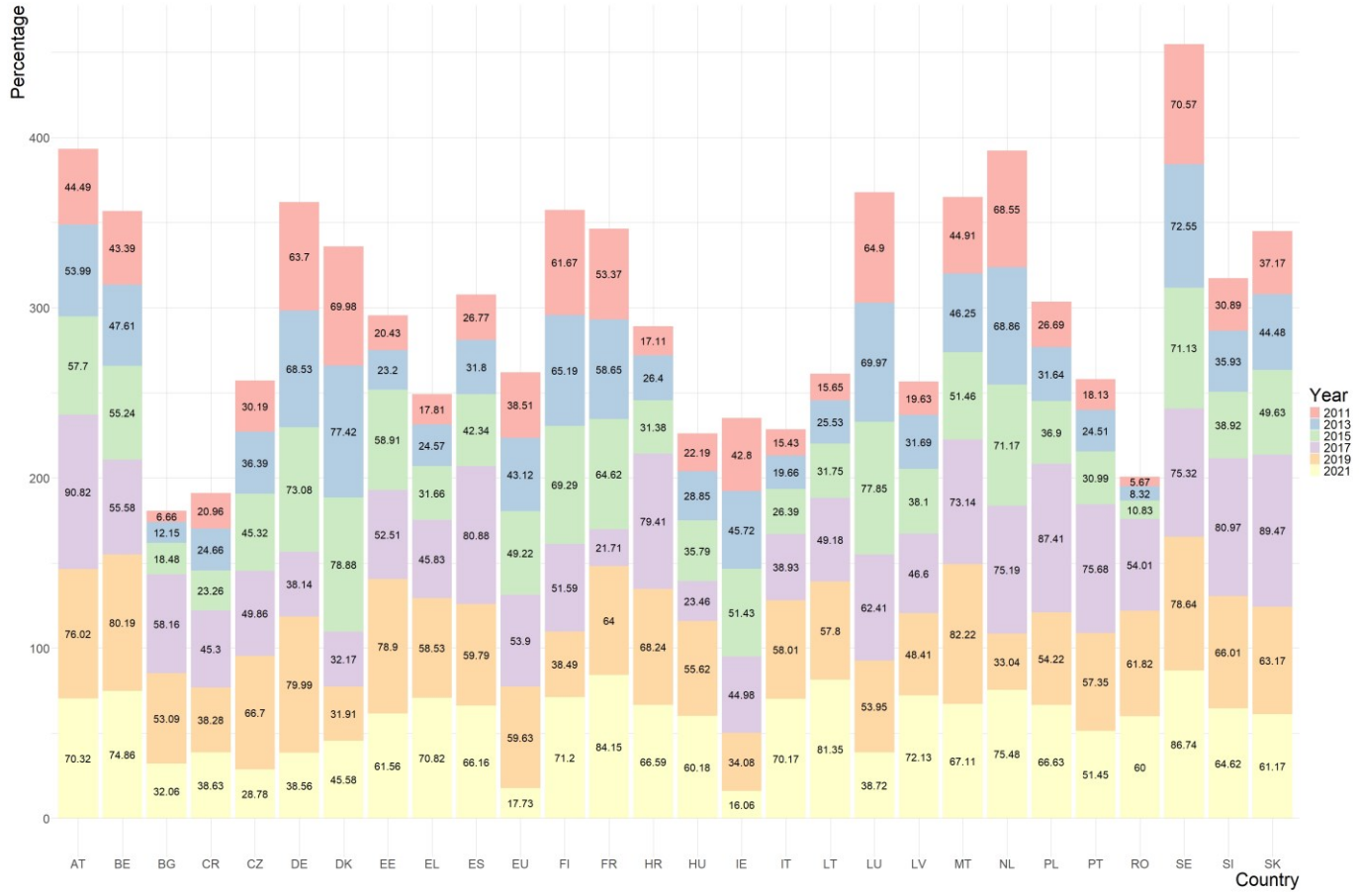

Figure 1. Share of online consumers in the EU countries.

Figure 1 shows the share of individuals who made at least one online purchase in the monitored period. All EU countries show an increasing trend in the monitored period, except for Germany in 2021, Luxembourg in 2019 and Estonia, Croatia, and Bulgaria in 2017. In 2011, Romania and Bulgaria recorded the lowest share of online shoppers, with levels below 7%. These countries have also recorded the lowest share

in other years, despite an increasing trend, with their share of online shoppers approaching 40% in 2021. Sweden recorded the highest share in 2011 (70.57%), followed by Denmark (69.98%). Germany, Finland, Luxembourg, and the Netherlands also recorded high shares (above 60%) in 2011. The average for EU countries in that year was 38.51%. In all other years, Denmark recorded the highest share of online shoppers, except for 2017, where Sweden recorded the highest share of online shoppers. As for 2021, the highest share of online shoppers was recorded in Denmark (90.82%), followed by the Netherlands (89.47%). Sweden and Ireland also recorded a share of almost 90%. The EU average was close to 70%. Belgium, the Czech Republic, Germany, Estonia, Finland, France, Luxembourg, Slovenia, and Slovakia achieved a share above 70%, which was above the average for all EU countries. The most significant increase in 2021 compared to 2011 was recorded by Estonia (+49.89%), followed by the Czech Republic (+45.29%) and Ireland (44.61%).

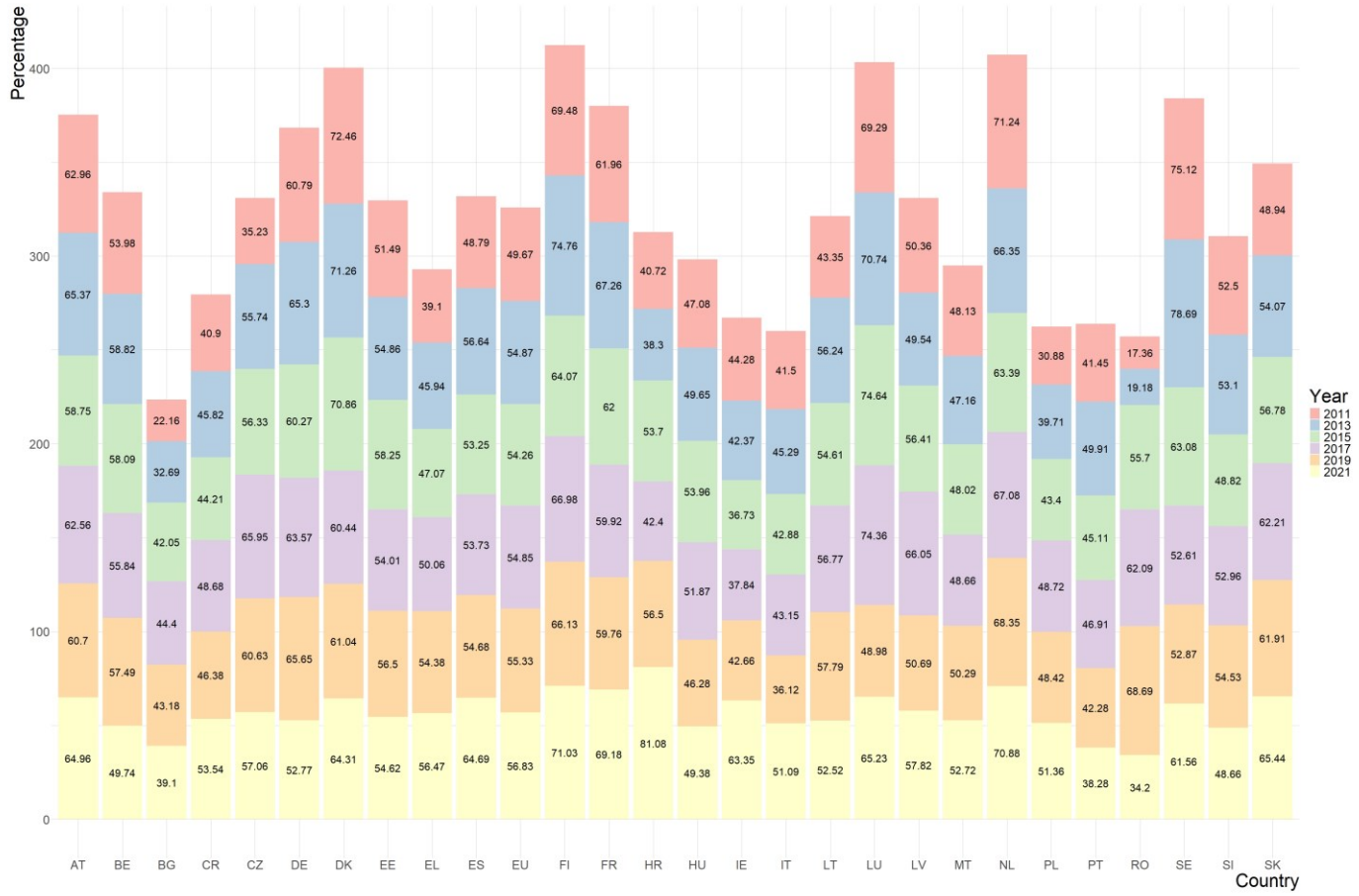

Figure 2. Share of online consumers who have certain level of digital skills.

Figure 2 shows the share of individuals who have certain level of digital skills, which can be related to the share of online consumers. It is not possible to identify a clear trend in digital skills from the graph, as fluctuations can be observed across countries over the years. In almost all countries, a downward trend can even be observed in some years. In 2011, Bulgaria recorded the lowest share (22.16%). The average of the EU countries was 49.67%. Belgium, Estonia, Greece, Spain, Hungary,

Latvia, Malta, Slovenia, and Slovakia recorded a share comparable to the EU average. In the following years, Romania, Ireland, Croatia, Italy and again Romania recorded successively the lowest shares. Sweden recorded the highest share in 2011 (75.12%). In 2021, the highest share was recorded in Croatia (81.08%), followed by Finland (71.03%) and the Netherlands (70.88%). The countries Austria, Denmark, Spain, France, Ireland, Luxembourg, Sweden, and Slovakia recorded levels above 60%. This finding is quite surprising, given that Croatia is ranked only 19th in the EU according to the DESI index (European Commission, 2023). However, in terms of integrating digital technology, Croatia holds the 14th position among EU member states. Despite a high percentage of consumers with digital skills, the country still faces a shortage of ICT specialists. To address this issue, Croatia has established the National Coalition for Digital Skills and Jobs to support the development of digital skills and to increase the number of digital specialists and jobs in the field (European Union, 2024).

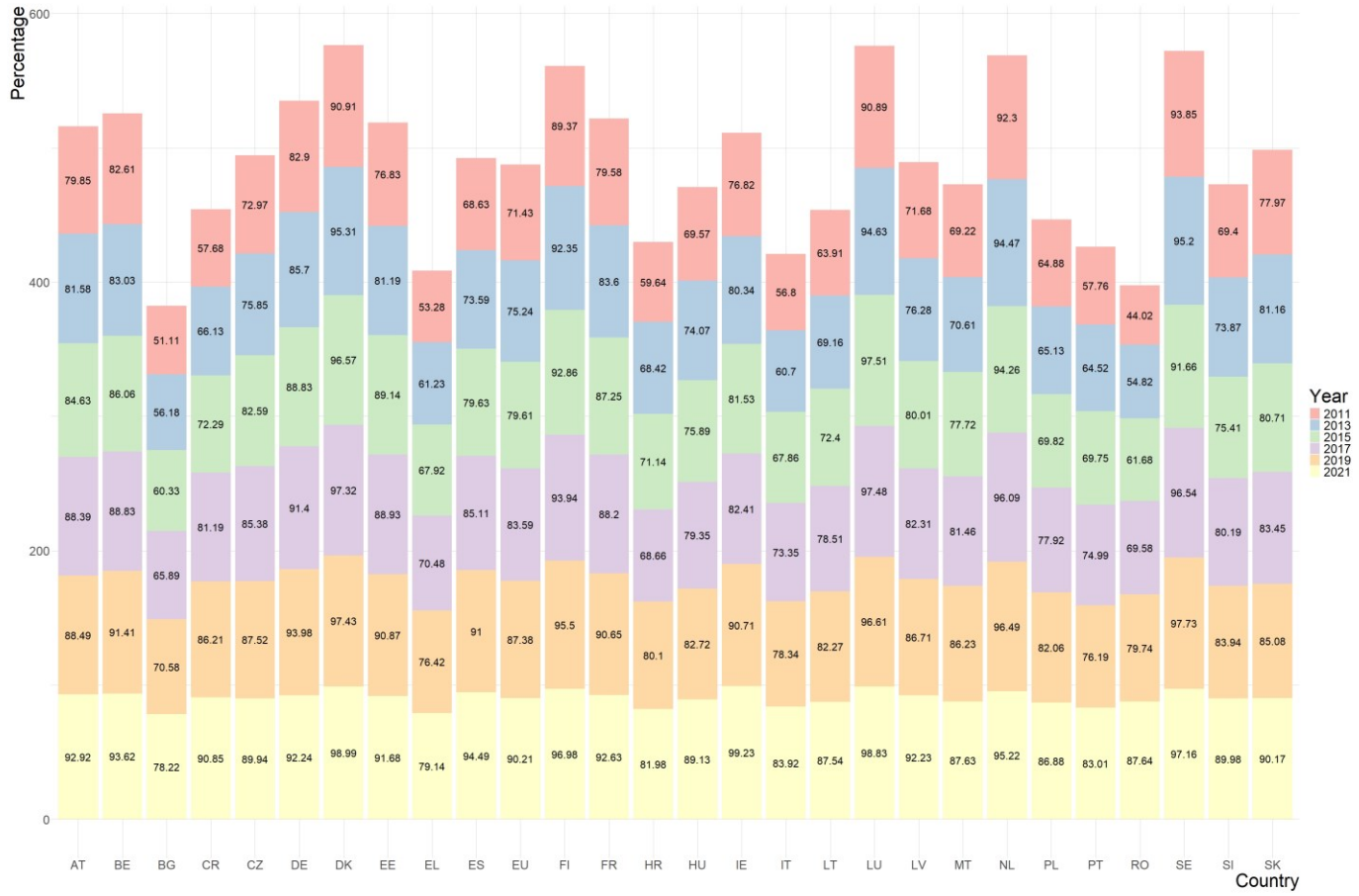

Figure 3. Share of internet users in the EU countries.

Figure 3 shows the share of internet users in the monitored period. All EU countries show an increasing trend in the monitored period, except for Germany and Sweden in 2021, Estonia, Croatia and Luxembourg in 2017, and also the Netherlands, Sweden and Slovakia in 2015. In 2011, Romania recorded the lowest share of internet users (44.02%), where the level was below 50%, followed by Bulgaria with 51.11%. These countries have also recorded the lowest share in other years despite

an increasing trend. Sweden recorded the highest share in 2011 (93.85%), followed by the Netherlands (92.30%), Denmark (90.91%) and Luxembourg (90.89%). Belgium, Germany, and Finland also recorded high shares (above 80%) in 2011. The average of the EU countries was 71.43% in that year. Sweden recorded the highest share still in 2019. As for the other years, Denmark, Luxembourg, and Luxembourg were the highest in 2013, 2015 and 2017 respectively. In 2021, Ireland recorded the highest share of internet users (99.23%), followed by Denmark (98.99%) and Luxembourg (98.83%). The EU average was 90.21% A share comparable to the EU average, i.e., above 90%, was also recorded in Austria, Belgium, Cyprus, Germany, Estonia, Spain, Finland, France, Latvia, the Netherlands, Slovakia. The most significant increase in 2021 compared to 2011 was recorded by Romania (+43.62%), followed by Croatia (+33.17%) and Bulgaria (27.11%).

When comparing the proportion of online consumers (**Figure 1**) and consumers with a certain level of digital skills (**Figure 2**), it is not possible to draw general conclusions. Countries such as Austria, the Czech Republic, Spain, Finland, France, Poland, and Slovakia recorded a comparable share of online consumers and a share of consumers with digital skills over the period under review. While in countries such as Bulgaria, Cyprus, Croatia, Greece, Italy, Romania and Croatia, the share of consumers with digital skills was higher than the share of online consumers over the period. In contrast, in countries such as Belgium, Germany, Denmark, Ireland, Luxembourg, the Netherlands and Sweden, the share of online consumers was significantly higher than the share of consumers with digital skills.

When comparing the share of online consumers (**Figure 1**) and internet users (**Figure 3**), it can be argued that both shares grew in direct proportion, i.e., if the share of internet users increased, so did the share of online shoppers. This was to be expected, given the increasing number of users who have access to the Internet and also the growing popularity of online shopping each year.

In this respect, it is also essential to mention the impact of the COVID-19 pandemic. It is clear from the figures that during the COVID-19 pandemic, not only Internet use but also online shopping increased in direct proportion. However, this cannot be consistently claimed for the level of digital skills. On the other hand, it is highly likely that if more recent data were available, it would be possible to observe an upward trend in consumers' digital skill levels as well. The COVID-19 pandemic has forced not only businesses but also consumers to move a lot of activities to the online environment of the Internet, and therefore it is possible to expect a significant impact of this pandemic on the use of the Internet, and online shopping, but also the need to increase the level of digital skills.

It is crucial to highlight that in 2021, amidst the global struggle with the COVID-19 pandemic, the significant rise in online shopping was predominantly driven by pandemic-related measures. These measures prompted consumers to change their behavior and preferences, moving away from traditional in-store shopping towards online platforms. The pandemic notably accelerated the adoption of digital technologies for various activities such as accessing internet services, working remotely, and online shopping (Erjavec and Manfreda, 2022; Lavuri, 2023).

Table 1 shows the results of testing the first research hypothesis. The *F* test confirmed significant structure within the countries under study. Hausman test

confirmed the appropriate use of Within model or fixed effects estimator in panel data analysis. The Breusch-Pagan test did not show significant heteroskedasticity of the data.

Table 1. Research hypothesis 1 (RH1) verification.

***F* test for individual effects**					
F	7.708	df1	29	*p*-value	0.000
		df2	220		
Hausman test					
chisq	73.315	df	1	*p*-value	0.000
Breusch-pagan test					
BP	0.563	df	1	*p*-value	0.453
Output from model (RH1)					
digital skills	0.3787	se	0.1715, 0.5858	*p*-value	0.0005
observations	251	R^2	0.551	adjusted R^2	−0.0737
F statistic	12.8329	df1	1	Result	RH1 accepted
		df2	220		

Table 2 shows the results of testing the second research hypothesis. The *F* test confirmed significant structure within the countries under study. Hausman test confirmed the appropriate use of Within model or fixed effects estimator in panel data analysis. The Breusch-Pagan test demonstrated significant heteroskedasticity in the data and therefore the Arrelano (1987) estimator was used.

Table 2. Research hypothesis 2 (RH2) verification.

***F* test for individual effects**					
F	10.783	df1	29	*p*-value	0.000
		df2	331		
Hausman test					
chisq	20.000	df	1	*p*-value	0.000
Breusch-pagan test					
BP	10.070	df	1	*p*-value	0.001
Output from model (RH1)					
digital skills	1.3796	se	1.1212, 1.6381	*p*-value	0.000
observations	362	R^2	0.7924	adjusted R^2	0.7736
F statistic	1263.4980	df1	1	Result	RH2 accepted
		df2	331		

The results of the regression model confirmed RH1, i.e., there is a statistically significant effect of the level of digital skills on consumers' online shopping. It can be argued that if the level of consumers' digital skills increases, the proportion of online shopping will also increase.

The results of the regression model confirmed RH2, i.e., there is a statistically significant effect of internet usage on online shopping. It can be argued that if the share of internet users increases, the share of online shopping will also increase.

The findings of the research conducted are in line with the findings of previous research, e.g., Khan et al. (2014) and Khan et al. (2020), who demonstrated the existence of a significant effect of digital skills and internet usage on social media usage, which ultimately led to the conclusion that online shopping can be predicted through the factors. Pérez-Amaral et al. (2020) in their research point to the importance of increasing digital skills and digital literacy in order to increase the use of e-commerce. The growing relationship between digital skills and e-commerce points to the increasing importance of digital skills development and promotion in public education (Fernández-Bonilla et al., 2022; Valarezo et al., 2019). Martínez de Ibarreta and Gijón (2015) found in their research that digital skills and internet use largely influence online shopping, with the higher the level of digital skills reported by consumers, the more they shopped online. Similarly, the higher the frequency of internet use was recorded among consumers, the more they used e-commerce.

4. Conclusion

The main aim of the paper was to examine and evaluate the evolution of consumers' digital skills and internet usage in the European Union and to identify potential significant impacts on online shopping. The research objective has been met.

Almost all EU countries have seen an increasing trend of online consumers during the period under review. The lowest share of online shoppers was in Romania and Bulgaria. Sweden and Denmark recorded the highest shares. The most significant year-on-year increase was recorded in Estonia. The development of consumers with digital skills has been volatile and in some EU countries has been declining year-on-year. Bulgaria, Romania, Ireland, Croatia, Italy and again Romania recorded successively the lowest shares. Conversely, the highest shares have been recorded over the years in Sweden, Luxembourg, Romania, and Croatia. Except for a few countries, the share of internet users has followed an increasing trend year-on-year over the period under review. The lowest shares were recorded in Bulgaria and Romania, while the highest shares were recorded over the years in Sweden, Denmark, Luxembourg, and Ireland. When comparing the share of online consumers and the share of consumers with digital skills, it is not possible to generalize the results. In selected countries the values were at comparable levels (Austria, Czech Republic, Spain, Finland, France, Poland, Slovakia), in some countries the share of consumers with digital skills was higher than the share of online consumers (Bulgaria, Cyprus, Croatia, Greece, Italy, Romania) and in others the opposite was true (Belgium, Germany, Denmark, Ireland, Luxembourg, the Netherlands and Sweden). Comparing the share of internet users and online consumers, a directly proportional trend was found. The results of testing the research hypotheses showed the existence of a statistically significant impact of digital skills on online shopping and also of internet usage on online shopping.

A possible limitation of the research may be the lack of relevant data, as several missing values for the level of digital skills were recorded for selected countries or years, which was subsequently adapted to the selection of data in the research. Future research could focus on comparing the data collected from EU countries with data from overseas countries or Far East countries. If researchers were able to obtain these data, it would be possible to explore significant differences or similarities between the countries. On the other hand, the existence of significant differences in the level of digital skills in relation to online shopping in terms of consumers' socio-demographic characteristics, e.g., gender, could be explored.

Increasing consumers' digital literacy and skills is definitely an important step for e-commerce to move forward. As a large number of traditional activities can now be carried out in the online space, it is essential that consumers improve and develop their digital skills. Just as the development of digital technology and the internet is advancing, so is the need to keep up with the times. Consumers should know how to communicate in the online space, how to send and share files, how to make online purchases, how to carry out online financial transactions and how to use other services in the online space. However, developing management skills for the online business environment, ensuring appropriate and reliable logistics networks, and developing and implementing legislative and regulatory e-commerce policies are also important for the survival of e-commerce in a digital marketplace full of competition. These are challenges that, if mastered, can lead to the adoption and use of e-commerce even in countries where adoption rates are not yet high (Alyoubi, 2015; Cuzovic and Labovic, 2019; Kiel et al., 2017; Sila, 2019). Thus, the results obtained can inform online retailers specifically in promoting the increase in digital literacy and skills of consumers, which can lead to increased internet usage and ultimately translate into increased sales and revenues from e-commerce.

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