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Analyzing E-Commerce of Small and Medium-Sized Enterprises in the European Union: Dependencies and Trends in the Context of Digitalization

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Abstract- **The presented study analyses the implementation of e-commerce by small and medium-sized enterprises in the countries of the European Union. The main objective of the study is, based on analysing the sales of small and medium-sized enterprises in e-commerce by enterprise size and the relative share of turnover obtained from e-commerce, during the period 2013-2023, to identify the emerging dependencies, as well as to establish development trends. The importance of the digitalization of the business of small and medium-sized enterprises through e-commerce is emphasized. Development trends are established and the indicator for the average annual growth rate is determined. The adopted methodological framework for conducting the study includes the application of the IBM SPSS Statistics software product, the Excel program, as well as the use of the linear regression and correlation method. The respondents of the study are a set of small and medium-sized enterprises from the 27-member states of the European Union. The results of the analysis show that the relative share of SMEs in the countries studied that engage in e-commerce and the turnover generated by e-sales vary significantly over the period under analysis. Differences are identified across European countries. The business opportunities of SMEs to implement e-commerce in digital environments are interpreted. Such studies help to identify upcoming changes in the business models of European SMEs.**

Keywords- e-commerce, digitalization, small and medium-sized enterprises.

I. INTRODUCTION

Digital transformation has a significant contribution to the development of economies and societies. The introduction of new technologies and digital processes transforms the business models of small and medium-sized enterprises, changes consumer behaviour. In 2021, the European Commission identified the opportunities for digital transformation of Europe by 2030 [1]. The progress of the digital performance of the European Union member states is monitored through the Digital Economy and Society Index (DESI). In this context, existing challenges facing the digital transformation of small and medium-sized enterprises are outlined. The integration of digital technologies is determined as a priority area, covering two areas: business digitalization and e-commerce. Therefore, e-commerce is determined as an essential component of the index.

According to the World Bank, small and medium-sized enterprises account for a large proportion of the total number of enterprises in most economies, especially in developing countries [2]. They contribute to job creation and global economic development. They account for a significant portion of the Gross Domestic Product of each country. This makes these enterprises a high priority for individual countries, including those in the European Union.

In this context, the level of integration of small and medium-sized enterprises into digital transformation should be established. This creates opportunities for expansion and outlining strategies for business internationalization through digital platforms [3]. Small and medium-sized enterprises are embracing digital technologies to gain a competitive advantage over their competitors, creating additional value, increasing productivity and profitability. The implementation of cutting-edge technologies contributes to improving the production capabilities of small and medium-sized enterprises within the framework of Industry 4.0 [4].

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Along with the opportunities, digital technologies create barriers for small and medium-sized enterprises in terms of available resources and limited size [5]. Studies show that their digitalization strategies primarily cover shorter time periods compared to large enterprises.

In the specialized literature, numerous studies focus on the main digital factors that ensure dynamic economic progress. For example, some of the studies are aimed at studying the impact of e-commerce on the economic development of countries, including the 27-member states of the European Union. The economic contribution of e-commerce, carried out by various businesses, in the creation and formation of the Gross Domestic Product is studied.

In the digital economy, e-commerce is becoming an essential technological tool, stimulating the innovation of small and medium-sized enterprises, changing their business models, as well as creating new consumer profiles [6]. E-commerce, as a modern innovative system, is determined as a factor of sales growth and an opportunity to participate in global markets [7]. It leads to an evolution of the commercial business. It changes the buying and selling of goods or services and improves the relationships and communication between customers and suppliers [8].

As confirmed in their scientific works by researchers F. Pantelimon, T. Georgescu and B. Posedaru, e-commerce is defined as an economic activity related to the purchase and sale of goods and services through online platforms [9]. Through e-commerce, the business carried out by small and medium-sized enterprises is expanded in an online environment. Thus, some studies consider e-commerce as one of the main conditions for the adoption of innovative marketing solutions, as well as for business development through the establishment of optimal customer relationships [10].

The adoption of e-commerce by SMEs is influenced by a number of internal and external determinants, including technological ones. At the enterprise level, e-commerce optimizes the structured supply chain, providing data on inventory, production, sales [11], [12]. Considering the operational efficiency of the business necessitates combining offline and online channels for marketing. Cross-border e-commerce creates conditions for reducing distribution costs.

Based on the aspects thus presented, it is considered appropriate for this study to focus on analysing the development of e-commerce at the level of small and medium-sized enterprises.

The main objective of the study is to identify the emerging dependencies and development trends, based on an analysis of the sales of small and medium-sized enterprises in e-commerce by enterprise size and the relative share of turnover obtained from e-commerce, during the period 2013-2023. At the same time, the research interest is to emphasize the importance of the digitalization of the business of small and medium-sized enterprises through e-commerce. In this regard, development trends are established and the indicator for the average annual growth rate is determined.

The analysis of e-commerce of small and medium-sized enterprises requires the following restrictive conditions to be introduced in this study: interpretation of trade type studies through empirical data relating to the 27-member states of the European Union during the period 2013-2023; study of the relationship between the total turnover of small and medium-sized enterprises from e-commerce sales and enterprises of the specified size whose website provides tracking of online orders. The study of the relationship between the selected variables allows reaching results reflecting a certain aspect of the development of e-commerce in Europe.

II. MATERIALS AND METHODS

This study aims to analyse more significant manifestations of the digitalization of small and medium-sized enterprises' business through e-commerce. In this context, the respondents of the study are small and medium-sized enterprises operating in the 27-member states of the European Union, carrying out e-commerce sales.

The analysis refers to data published by the European Statistical Office - Eurostat. This data has been collected and summarized using a methodology that allows for the analysis and evaluation of the e-commerce of the highlighted enterprises.

The methodological framework of the study includes measuring the emerging dependencies using the method of linear regression and correlation. In order to analyse and evaluate the sought dependencies, statistical software for computer processing is applied - IBM SPSS Statistics, as well as the capabilities of the Excel program. The analysis is carried out in two steps, ensuring logical consistency, namely:

- first step of the analysis – analysing and interpreting the status and dynamics of e-commerce sales by small and medium-sized enterprises from the 27-member states of the European Union, as well as calculating the growth rate and the average annual growth rate of the share of the surveyed small and medium-sized enterprises with e-sales;
- second step of the analysis – analysing and assessing the correlation between the dependent variable of the total turnover of small and medium-sized enterprises from e-commerce sales, and the independent variable of small and medium-sized enterprises with a website providing tracking of orders placed at the European level.

The outlined methodological framework helps to achieve the set objective of this study. This focus assumes that trends in e-commerce sales by enterprises from the 27-member states of the European Union are an important indicator of ongoing digitalization processes.

III. RESULTS AND DISCUSSION

Digitalization is transforming the business models of small and medium-sized enterprises. Available data on the various aspects of digitalization, including through e-commerce, of enterprises, including SMEs, at the European Union level allow for the analysis of the changes taking place in this area.

According to expert assessments, the use of digital technologies, including the possibilities of e-commerce, by small and medium-sized enterprises operating in the 27-member states of the European Union follows a trend of sustained and constant growth. [13]. The views held are supported by the available data published by the European Statistical Office – Eurostat [14].

According to the first step of the analysis, defined in this study, the status and dynamics of e-commerce sales by small and medium-sized enterprises operating in the 27-member states of the European Union are analyzed and assessed. According to Eurostat data for the ten-year period 2013-2023, in 2023 the relative weight of the enterprises in question reporting e-commerce sales turnover reaches 12.09%, which is 4.21 percentage points more than in the initial year of the period – 2013. The values reported in this way are favorably influenced by various factors, including: increasing application of information and communication technologies; electronic data exchange; use of websites, applications, marketplaces, online platforms and others.

The dynamics of change in the relative share of the total turnover of small and medium-sized enterprises from e-commerce sales, as well as the variation in the relative weight of small and medium-sized enterprises with a website providing tracking of orders placed, at the level of the 27-member states of the European Union, are illustrated by Fig. 1.

The reported changes in the relative share of the total turnover of small and medium-sized enterprises from e-commerce sales, as well as in the relative weight of small and medium-sized enterprises with a website providing tracking of orders placed at the level of the 27-member states of the European Union, allow us to conclude that both variables follow a favorable growth trend.

At the same time, the comparative analysis shows that certain countries report higher values compared to the average of 10.31% for the European Union for the share of the total turnover of small and medium-sized enterprises from e-commerce sales.

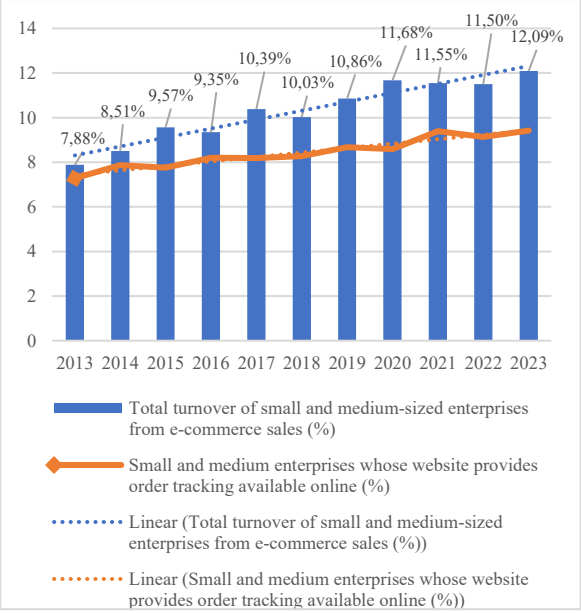

Fig. 1. Dynamics during the period 2013-2023 of the relative share of the total turnover of small and medium-sized enterprises from e-commerce sales and dynamics of the relative share of small and medium-sized enterprises with a website providing tracking of orders placed, at the level of the 27-member states of the EU.

Source: Eurostat data and author's calculations.

In 2023, the highest values, significantly exceeding the average, are as follows: Ireland - reporting a value of 21.13%; Czech Republic - 18.82% and Denmark 18.65%. Comparatively, countries such as Bulgaria and Romania have relatively lower values. At the same time, both countries report an increase and growth of the analyzed indicator in 2023 compared to the initial year of the study period - 2013, as follows: for Bulgaria the increase is more than 4 times, and for Romania - more than 2 times.

The use of a correlogram allows us to visualize the relationship between the total turnover of small and medium-sized enterprises from e-commerce sales and the functioning website that provides tracking of online orders. With the help of the following Fig. 2. the trend model is visualized, as well as the emerging regression line. The described regression line visualizes the relationship between the factor and the resulting quantitative value determined in this study.

As can be seen from the figure, during the period 2013-2023, there is an upward trend in the relative share of the analyzed enterprises with a website, varying between 7.28% and 9.42%. A similar favorable growth trend is observed for the other variable – its variation is between 7.88% and 12.09%, with the second value being reached at the end of the evaluated period. The same figure also shows that the coefficient of determination takes the value as follows: $R^2 = 0.8445$. Therefore, the value of the correlation coefficient is a positive number, which is closer to unity and indicates the presence of a stronger relationship.

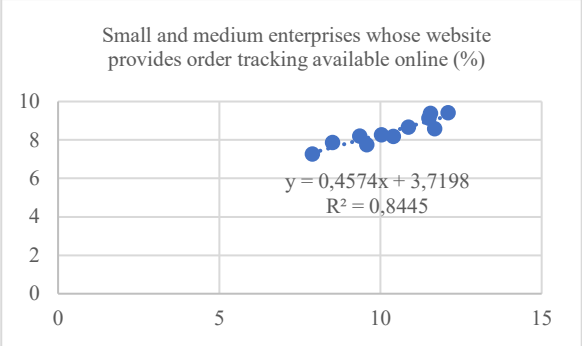

Fig. 2. Dynamics during the period 2013-2023 of the relative share of small and medium-sized enterprises with a website providing tracking of orders placed, in the 27-member states of the EU.

Source: Eurostat, https://ec.europa.eu/eurostat/databrowser/view/isoc_ec_esels/default/table?lang=en; author's calculations.

Within the same analytical step, the growth rate and the average annual growth rate of the share of surveyed small and medium-sized enterprises with e-sales are calculated. The values of both indicators are visualized in Table 1.

TABLE 1 CHANGE IN THE SHARE OF SMALL AND MEDIUM-SIZED ENTERPRISES FROM THE 27-MEMBER STATES OF THE EUROPEAN UNION WITH E-COMMERCE SALES DURING THE PERIOD 2013-2023

Region	**Indicators**	
	Growth rate (2023/2013)	***Average annual growth rate (2023/2013) Subhead***
EU-27	0.4065	1.0435

Source: Eurostat data and author's calculations.

As shown in Table 1, during the period 2013-2023, the growth rate of the relative share of small and medium-sized enterprises from the 27-member states of the European Union with e-commerce sales takes the value as follows: 0.4065. The resulting value expresses the speed of development of the variable under study over the selected long period of time. The average annual growth rate also reflects the average speed of development, and it should be noted that within the period 2013-2023, a positive increase in the measured relative share of the surveyed enterprises with e-commerce sales is achieved by 1.0435 times.

The second step of the analysis directs the research interest to interpret the correlation between the variable of total turnover of small and medium-sized enterprises from e-commerce sales, on the one hand, and the variable – small and medium-sized enterprises with a website providing tracking of orders placed, on the other hand. Determining the direction of the relationship between the two variables necessitates the conduct of a regression analysis.

The application of the linear regression and correlation method allows reaching certain research results, illustrated by the following tables. Table 2 illustrates the indicators of regression statistics.

TABLE 2 REGRESSION STATISTICS INDICATORS

№	**Regression Statistics**	
	Indicators	***Values***
1.	Multiple R	0.9189
2.	R Square	0.8445
3.	R Square	0.8272
4.	Standard Error	0.2851
5.	Observations	11

Source: Eurostat data and author's calculations.

According to the data visualized in Table 2, it is found that the linear regression coefficient, coinciding with the correlation coefficient, takes a positive value closer to unity. The considered coefficient measures the tightness of the linear correlation between the two variables. Since the condition that $0.7 < R = 0.9189 < 1$ is met, it is concluded that a strong single linear correlation is established between the two evaluated variables – the total turnover of small and medium-sized enterprises from e-commerce sales, and the variable – small and medium-sized enterprises with a website providing tracking of orders placed.

The second coefficient illustrated in Table 2 is the coefficient of determination. According to the data, its value is as follows: $R^2 = 0.8445$. The given value allows us to state that over 84% of the differences between small and medium-sized enterprises from the 27-member states of the European Union in terms of realized turnover from e-commerce sales are due to and explained by the differences between them in terms of a functioning website that provides tracking of orders placed. The data in the same table also shows the values of the specified coefficient of determination, assuming the favorable value of 0.8272, of the standard error, as well as of the eleven years surveyed in total, included in the analyzed period 2013-2023.

Table 3 presents values that help verify the adequacy of the regression model.

TABLE 3 ANOVA

Indicators	**Anova**		
	Sum of Squares	***Mean Square***	***F***
Regression	3.9749	3.9749	48.8945
Residual	0.7316	0.0812	
Total	4.7066		
Sig-significance F	0.0001		

Source: Eurostat data and author's calculations.

As can be seen from the data in Table 3, the verification method, i.e. F - the criterion, takes a value that amounts to: F = 48.8945. Provided that the risk of a first type error is 5% ($\alpha = 0.05$), it is established that the explained variance

of the dependent quantitative variable is over 48 times greater than the variance of the error. Since the significance level Significance F = 0.0001 < 00.5 = α, it is reasonable to conclude that there is a natural dependence of the variable - the total turnover of the studied small and medium-sized enterprises from e-commerce sales, on the built and functioning website, providing tracking of the orders placed. Therefore, the estimated regression model is adequate and can be used for further study of the dependence.

The data in the following Table 4 helps determine the type of linear regression equation.

TABLE 4 COEFFICIENTS

Indicators	**Coefficients**		
	Coefficients	***Standard Error***	***t Stat***
Intercept	3.7198	0.6798	5.4714
Total turnover of small and medium-sized enterprises from e-commerce sales	0.4574	0.0654	6.9924

Source: Eurostat data and author's calculations.

In this case, the linear regression equation takes the following form (1):

$$y = 0.4574 + 3.7198 \quad (1)$$

The resulting regression equation helps measure the average change in the outcome variable - the total turnover of small and medium-sized enterprises from e-commerce sales, with a unit increase in the factor variable - small and medium-sized enterprises with a website that provides tracking of orders placed.

Therefore, based on the data illustrated in both Fig. 2 and Table 4, the implementation of the relevant analysis allows us to reach the following conclusion: if the variable measuring the relative share of small and medium-sized enterprises from the 27-member states of the European Union with a website that provides tracking of online orders, changes by one unit, this will lead to a positive change in the direction of increasing the total turnover of the surveyed enterprises from e-commerce sales by an average of 3.7198 units.

The research results thus obtained provide grounds for reporting a high correlation or strong dependence between the two quantitative variables studied in the presented work. In addition, these results allow for a certain interpretation of the digital changes occurring in small and medium-sized enterprises from the 27 countries of the European Union. The specific focus placed on the website built, ensuring the tracking of online orders, allows for measuring its impact on the total turnover of sales realized in e-commerce.

In the research area thus outlined, there is an opportunity for discussion. It is relevant and practically useful to compare with the results obtained, published in the specialized literature by other researchers. For example, in scientific works dedicated to analyzing and interpreting the impact of digital technologies on the sustainable development of various economic sectors in the European Union, certain determinants are highlighted and corresponding business effects are measured [15]. In addition, significant findings are derived in the behavior of consumers, considered as counterparties in the process of making online purchases through a wide range of web-based tools [16]. The consideration of similar studies helps the process of directing research interest to the selected issue. In this area, econometric models are used that evaluate different groups of determinants of an economic, demographic and other nature. In this sense, the basic research position is the belief that the business of European small and medium-sized enterprises operating in various sectors of the economy is increasingly determined by the strength of the impact of a number of determinants, among which digitalization stands out, including the implementation of e-commerce and the application of website tools.

IV. CONCLUSIONS

This study, presenting theoretical and empirical aspects of the economic benefits of business digitalization for small and medium-sized enterprises from the 27-member states of the European Union, provides a basis for reaching certain conclusions and generalizations. The results obtained from the analysis show that during the ten-year period 2013-2023, the growth rate of the relative share of the surveyed European enterprises with e-commerce sales follows a favorable trend of growth by more than one time. The outlined trend of change is an important indicator of the ongoing processes of digitalization. The conclusion is drawn that over 84% of the differences between small and medium-sized enterprises from the 27-member states of the European Union in terms of realized turnover from e-commerce sales are due to and explained by the differences between them in terms of a functioning website that provides tracking of online orders. In this analytical direction, the increase by one unit in the relative share of the analyzed enterprises with a website affects the positive increase by an average of over 3.72 units in the turnover from realized sales in e-commerce. The comparative analysis also allows us to highlight that during the studied period within the European Union, progress is being made towards increasing the degree of digitalization of the business of small and medium-sized enterprises. These trends are most pronounced in countries such as Ireland, the Czech Republic and Denmark. In their entirety, the research results obtained in this way, reflecting a certain aspect of the development of e-commerce in Europe, can be useful for identifying the necessary transformations and stimulating the digitalization of small and medium-sized enterprises' businesses.

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