

The Role of Advanced Technologies on E-Commerce Sales During (Covid-19) Pandemic Time

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Abstract: Thanks to the appearance of the Internet and the ongoing digitalization of modern life, today, consumers from all world have a need to use electronic commerce (E-commerce). Nowadays, especially due to the emergence of the COVID-19 pandemic that led to limited human activities, there is a need to clarify how enterprises can find new opportunities in the digital business environment. Hence, the purpose of this study is to examine how using of advanced information and communication technologies (ICT) impact sales which realise through e-commerce in enterprises in the EU countries. This research is based upon quantitative from the Eurostat database for 2020 data. The analysis has involved the enterprises which achieved at least 1% turnover with e-commerce sales. The results obtained using the Multiple Linear Regression (MLR) indicates that cloud computing services the most contribute to e-commerce in COVID-19 time.

Keywords: E-commerce sales, enterprises, EU, information and communication technologies

1 INTRODUCTION

Electronic commerce (E-commerce) represents the process of buying and selling goods in a digital environment using online platforms and websites on the Internet (Ghandour & Woodford, 2020). E-commerce is one of the most dynamic industries to have come up and which change very fast following the modern needs of the market and end consumers. Hence, the number of digital buyers also increase every year. In 2020, over 2 billion people purchased goods or services online, while e-retail sales surpassed 4.2 trillion US dollars worldwide (Coppola, 2021). These are just some of the facts that indicate the mass use of E-commerce. The main advantages of E-commerce to traditional trade are reflected creating an E-commerce website can be fast and easy, the operational costs for setup are lower, the use of websites and applications for E-commerce is easy, there is no time limit during the buying, greater availability of better products (Ghandour & Woodford, 2020). In spite of significant technological advancements, E-commerce and has some drawbacks (Tokar et al., 2021). In an online environment, consumers cannot physically see or try the desired product before making

purchase decisions (Lee et al., 2010), exist additional shipping costs, and the reliability of the seller can be questioned (Jędrzejczak-Gas et al., 2019).

The computerisation of society contributed to the development of E-commerce in EU countries. Today, E-commerce is using frequently, and as such becoming growingly important in all market segments, and occupies a significant share in total trade (Jędrzejczak-Gas et al., 2019). In order to enhance administrative cooperation between the EU countries has been adopted the foundational legal framework for online services and is the E-Commerce Directive which aims to remove obstacles in the provision of cross-border online services (European Commission, 2021). Using modern information and communication technologies (ICT) in enterprises contribute to improve the information management process, increase the reliability and speed of transactions for both business-to-business and business-to-consumer transactions. In addition, digital technologies are an effective tool for improving communication, promote the quality of services for new customers and keeping existing (OECD, 2004). The annual ICT indicators from the Eurostat database provide a snapshot of the active enterprises which use ICT in business, hence, the aim of this paper is to show how using of advanced ICT impact E-commerce sales. It is especially interesting to analyze these data during 2020 due to the COVID pandemic and the limited physical movement of people, when most of them were redirected to online shopping.

In light of previous facts the rest of this paper, through the following sections, is organised. After the introduction section, the second section presents the literature review of the E-commerce sales. The third section provides used methodology based on the Multiple Linear Regression, followed by a presentation of key findings in the fourth section. Finally, the last conclusion section considers the limitations and recommendations for improvements.

2 THEORETICAL BACKGROUND

The COVID-19 pandemic has disrupted consumer activity and business operations of enterprises and had a strong impact on the digital transformation of enterprises (Guthrie et al., 2021). E-commerce during COVID-19 time is a topic evidenced in numerous scientific papers.

The COVID pandemic has significantly affected the expansion of demand for e-commerce, which is why e-commerce has become a daily routine for a large number of consumers (Abiad et al., 2020). However, due to high demand, there were difficulties that appeared during delivery. Namely, many companies faced delays in deliveries because the countries were locked and the import and export of goods were difficult (Hasanat et al., 2020). Kim (2020) and Verma & Gustafsson (2020) were dealing with the investigation of the impact of COVID-19 on consumption behaviour. Ghandour & Woodford (2020) were investigated the impact coronavirus has had on the E-Commerce industry of the UAE before and during COVID-19 and determined a positive relationship in both periods. Based

on a detailed analysis of the scientific literature about COVID-19 research and the environmentally imposed constraints Guthrie et al., (2021) using a case study they investigated underlying behavioural motivations and causal mechanisms. The obtained results showed that consumers hoarded essential pharmaceutical goods during the COVID period. Bhatti et al., (2020) found that this whole new situation has led to high demand for certain products such as protective masks and disposable gloves, alcohol and disinfectants, in addition, people also have accumulated a lot of grocery products.

Changes in the market that have occurred due to the growing number of E-commerce users also have significantly affected the workforce. Biagi & Falk (2017) were examined the impact of ICT and E-commerce activities on labour demand before the COVID-19 pandemic. They determined that in the service industries, manufacturing industries, SMEs and large companies, the increase in E-commerce activities over time has not brought to a decline in jobs. However, The COVID-19 pandemic had a negative effect on the tourism industry, and the plane industry, as flights were suspended and arrangements cancelled (Bhatti et al., 2020), hence, the workers didn't work in that period.

During the pandemic period due to the larger volume of work, in order for companies to be able to operate successfully, it is necessary to effectively manage E-commerce platforms (Tran, 2021). Jędrzejczak-Gas et al. (2019) investigated the level of development of E-commerce in the EU and found that the most developed countries were Germany, Denmark, Czech Republic, while the lowest development of E-commerce found in Romania, Bulgaria, Malta and Cyprus.

In addition to the above, the promotion of E-commerce sales is also an important driver for successful management, development and increase in sales volume. With this issue, Habel et al. (2021) were dealing. This group of authors developed a theoretical framework that indicates important determinants of promotion using E-commerce channels.

3 MATERIAL AND METHODS

Based on empirical analysis of data from the EUROSTAT open database during 2020 in this research examines the impact of ICT usage in enterprises on E-commerce sales. In analyse were involved 26 EU countries that use advanced ICT in enterprises (except Greece, because of missing data) during the COVID-19 pandemic period. Analised information and communication technologies were divided into six groups (3D printing and robotics, Artificial intelligence, Big data analysis, Cloud computing services, Supply chain management, Internet of things). The defined research model is presented in Figure 1.

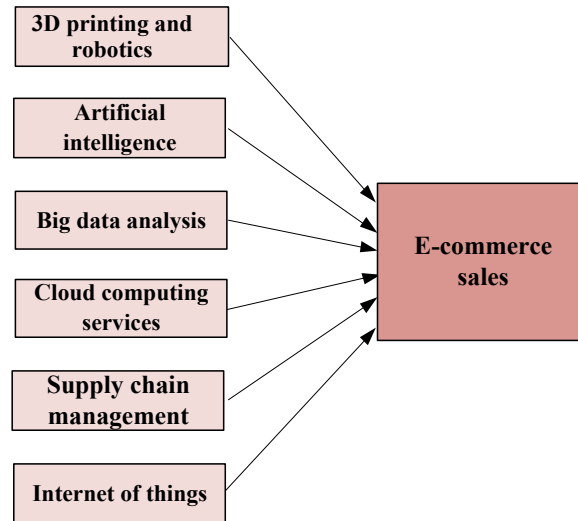


Figure 1.

Defined research model of E-commerce sales

A multiple linear regression model was employed for predicting the impact of independent variables on the dependent variable. In the defined model (Figure 1) E-commerce sales present a dependent variable, while the independent variables are advanced digital technologies that use enterprises today.

3.1 Multiple linear regression model (MLR)

Multiple linear regression (MLR), is a statistical technique that is used when want to predict the linear relationship between the dependent variable (the outcome, target or criteria variable) and two or more explanatory (independent) variables (Shams et al., 2021). Generally, the MLR model can be expressed as in Eq.1:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 \dots + b_nX_n + e_i \quad (1)$$

The dependent variable is Y, while, $X_1, X_2, \dots X_n$ are the independent variables, and $b_1, b_2, \dots b_n$ are vector of regression coefficients, and e_i is random measured errors (Olsen et al., 2021). In the present study, SPSS 22 was utilized to calculate the MLR models.

4 DISCUSSION OF RESULTS

Statistics of the data set for the analysing impact of digital technologies on E-commerce sales are depicted in Table 1. Mean values of percentage participation of enterprises indicate that Artificial intelligence is least used in enterprises (2.19) and 3D printing and robotics (4.69). On the other hand, enterprises most use Cloud computing services (38.22) and integration systems with customers/suppliers (30.69).

Table 1. Statistics of the data set for the prediction of E-commerce sales

	Min	Max	Mean	Median	SD	Skewness	Kurtosis
3D printing and robotics	2	9	4.69	5	1.91	0.329	-0.440
Artificial intelligence	1	5	2.19	2	0.98	0.687	1.012
Big data analysis	3	29	11.53	9	6.85	0.973	0.182
Cloud computing services	11	75	38.22	34	17.41	0.574	-0.624
Supply chain management	10	95	30.69	22	22.85	1.555	1.742
Internet of things	3	18	6.46	6	3.02	2.483	8.229

It was first analyzed the percentage share of enterprises that achieved at least 1% turnover with E-commerce sales. Based on the use of advanced digital technologies all EU countries (except Greece) were examined and obtained results are represented below. Only Greece is excluded from the analysis because data in this country were not collected for 2020. Figure 2 shows the percentage share of enterprises in EU countries that use 3D printing and robotics technologies in their business.

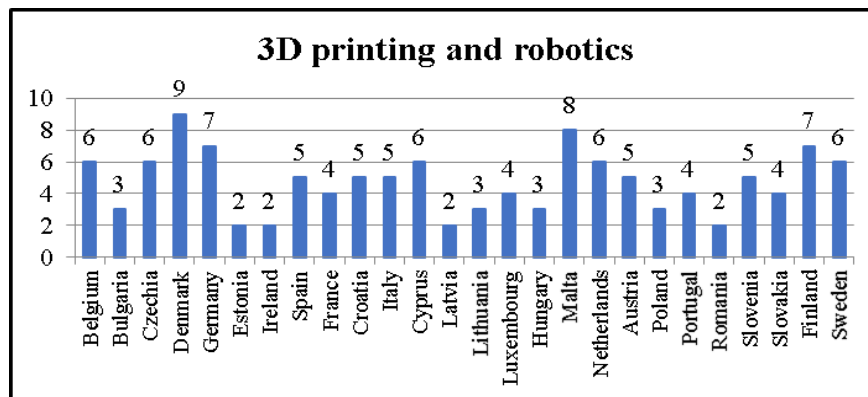


Figure 2.

Percentage share of enterprises in EU countries that use 3D printing and robotics

Three-dimensional (3D) printing construction techniques have been increasingly developed in recent years and a number of enterprises applicant them in practice. Using advanced 3D printing technology can achieve high flexibility and efficiency in production (Xiao et al., 2021). The EU countries whose enterprises use the most 3D printing and robotics are Denmark (9%), Malta (8%), Germany and Finland (7%). These are highly developed countries that follow the needs of the market. The percentage share of enterprises in EU countries that use artificial intelligence technologies in their business depicts in Figure 3.

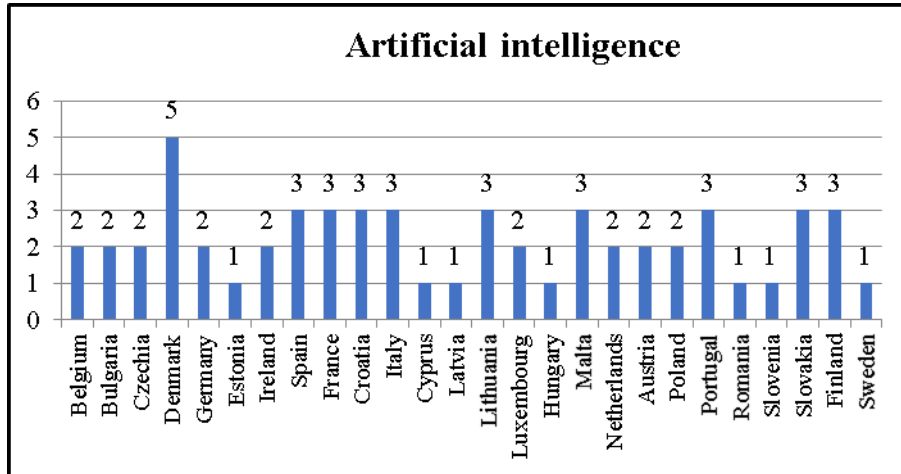


Figure 3.

Percentage share of enterprises in EU countries that use artificial intelligence

Artificial intelligence (AI) is a new generation of information and communication technologies, which has attracted much attention from industries, academia and governments. Artificial intelligence is a compilation of logic, computer science, philosophy, psychology, biology, and many other disciplines, and it has achieved remarkable results in applications such as image and natural language processing, speech recognition, processing, the proving of automatic theorems, and intelligent robots (Zhang & Lu, 2021). Most EU countries use artificial intelligence technologies uniformly, ie, very few, at most 3% of enterprises. Only enterprises in Denmark use AI a little more (5%). Figure 4 represent the percentage share of enterprises in EU countries that use big data analysis.

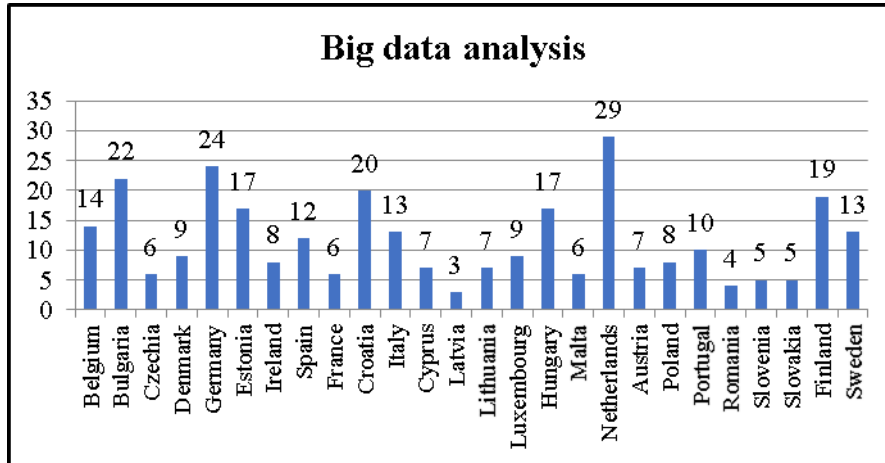


Figure 4.

Percentage share of enterprises in EU countries that use big data analysis

Big data analysis requires analyzing large amounts of data in order to discover the hidden patterns and make correct decisions in the business. Enterprises that use the power of technology and data are more objective data-driven. In many enterprises, the human resources department needs big data from different processes. Big data faced various problems from big data storage security problems (Yang, 2021). This segment of information technologies in all EU countries is significantly more used. The best-ranked country is the Netherlands with as many as (29%) enterprises, followed by Germany (24%). It is surprising that Bulgaria (22%) is in third place because it is one of the least developed EU countries. In addition to Bulgaria, another Balkan country is highly ranked, and that is Croatia with (20%). The share of enterprises in EU countries that use cloud computing services in their business shows in Figure 5.

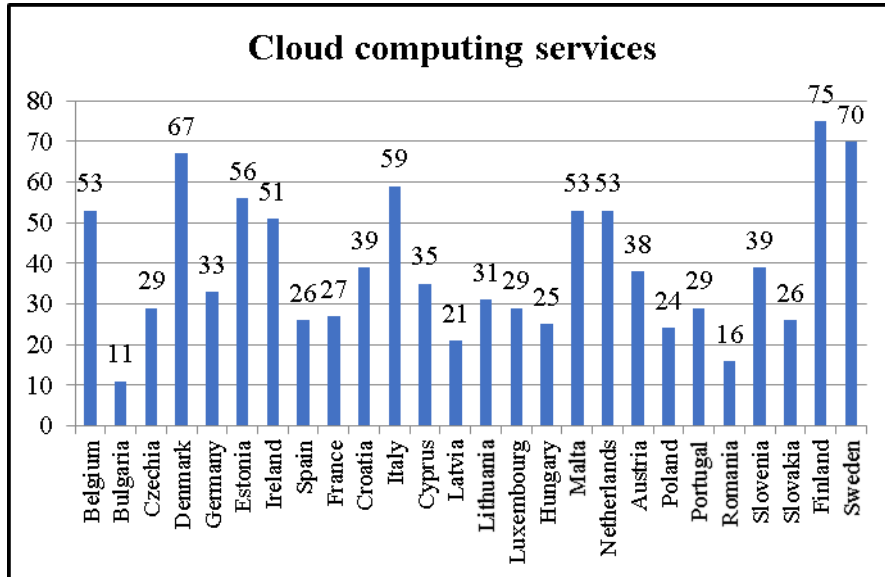


Figure 5.

Percentage share of enterprises in EU countries that use cloud computing services

Enterprises to achieve mass production in lower time, ensure the satisfaction of the customer, achieved dynamic management of customer orders and overcome restricted time to market the product, enterprises use cloud-based technologies (Brintha et al., 2021). This technologies offers leasing and utilizing manufacturing possessions, whenever the needed resources are based on demand to promote elasticity. Cloud computing services are represented in both more developed and less developed EU countries. A very high percentage of enterprises in Finland (75%) use these services, as well as in Sweden (70%) and Denmark (67%), while enterprises in Bulgaria (11%) use cloud computing services the least. Figure 6 shows the percentage share of enterprises in EU countries (except Greece) that integrated with customers/suppliers.

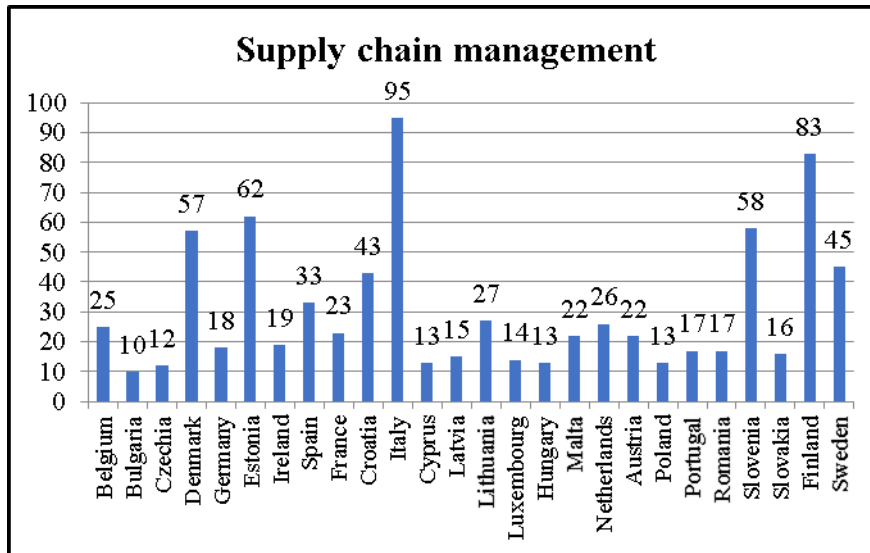


Figure 6.

Percentage share of enterprises in EU countries that use supply chain management

The managing supply chain has become complex due to globalization, strong competition and rising needs of customers on the market (Yadavalli et al., 2019). This process related to the active management of the flow of goods and services and includes all processes that transform raw materials into final products in order to achieve sustainable competitive advantage. This structural process consists of product development, sourcing, production, and logistics, as well as the information systems needed to coordinate these activities (Handfield, 2020). The most dominant country when it is a word about supply chain management in enterprises is Italy (95%), Finland (83%), Estonia (62%), while enterprises in Bulgaria (10%) use supply chain management the least, i.e the enterprises are not integrated with customers/suppliers. The share of enterprises in EU countries that use the Internet of things in their business shows in Figure 7.

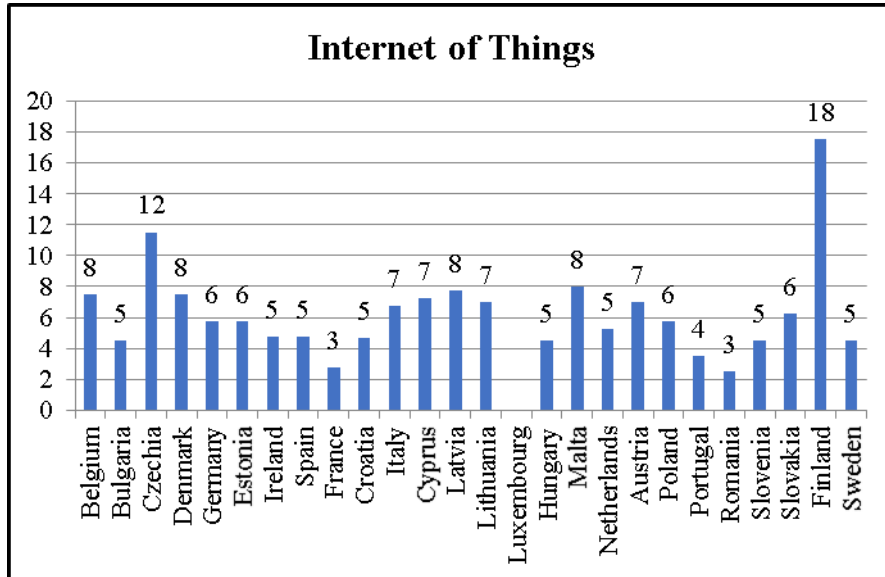


Figure 7.

Percentage share of enterprises in EU countries that use Internet of things

There are a lot of platforms for the Internet of things that have been developed. However, most of them are made for certain implementations and don't manage the current limitations of the recent systems. Internet of things is the key driving factor behind transforming all technology aspects (Ahmed, 2021). One of the advantages of advanced technologies related to the Internet of things is their availability by low costs, distance accessibility and the possibility of the connectivity of devices (Turjman, 2019).

In considered EU countries the enterprises using some of the following Internet of Things types: sensors RFID IP-tags, movement or maintenance sensors, sensors or RFID tags, Internet-of-Things devices. It is determined that within Finland (18%) and Czechia (12%) enterprises most use some of the analysed Internet of Things, while in the other EU countries this percentage is lower than (10%).

Table 2 shows the correlation matrix of the main independent variables. In addition to the values of each of the correlations, an asterisk was shown the p-value for the two-tailed test which indicate statistical significance at the 0.05 level, while two asterisks, which indicated statistical significance at the 0.01 level. It can be concluded that there is a medium and strong relationship between all variables.

Table 2. Correlation table with the two-tailed significance level (p-value) for the correlation coefficient

	3D printing and robotics	Artificial intelligence	Big data analysis	Cloud computing	Supply chain management	Internet of things
3D printing and robotics	1					
Artificial intelligence	0.480*	1				
Big data analysis	0.405	0.970	1			
Cloud computing services	0.571**	0.458	0.557	1		
Supply chain management	0.600	0.574	0.404	0.721**	1	
Internet of things	0.435*	0.208	0.830	0.470*	0.370	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

To estimate E-commerce sales the Multiple linear regression was employed. Obtained results are shown in Table 3. Firstly, the multiple correlation coefficient, coefficient of determination and F-test were calculated and obtained the following results. The multiple correlation coefficient (R) represents a measure of the quality of the prediction of the dependent variable and a value of 0.712 in the defined research model points out a good level of prediction. Additionally, the coefficient of determination (R^2) represents the proportion of variance in the dependent variable that can be explained by the independent variables, therefore, in the defined model independent variables explain 50.7% of the variability of the dependent variable (E-commerce sales). The F test depicts if whether the overall regression model is a good fit for the analysed data. The obtained results show that the regression model is a good fit for the data $F(6, 18) = 3.090$, $p < 0.05$.

Table 3. Results of the Multiple Linear Regression model

	Estimate	SE	t value	Sig.
3D printing and robotics	0.050	0.946	0.053	0.958
Artificial intelligence	2.713	1.497	1.813	0.087
Big data analysis	-0.240	0.190	-1.259	0.224
Cloud computing services	0.375	0.126	2.973	0.008
Supply chain management	-0.176	0.084	-2.109	0.049
Internet of things	-0.293	0.487	-0.601	0.555

In this survey of EU countries (excluding Greece) about the impact of the implementation of contemporary ICT on E-commerce sales, it is found significant relationships between the frequency of Cloud computing services and e-commerce sales, as well as between Supply chain management and e-commerce sales ($p < 0.05$ for each).

Specifically, it was determined a 0.18% decrease (± 0.084) in the Supply chain management (integration with customers/suppliers) impact e-commerce sales of at least 1% turnover. One of the reasons is due to COVID 19. International supply chains have become disrupted due to the lockdowns of countries all over the world (Ghandour & Woodford, 2020). If the EU wish to emerge as a leader in the E-Commerce industry of the world, they will have to carefully expand their supplier base by starting trade with new international partners.

Also, it is determined that a 0.38% increase (± 0.126) in the frequency of using Cloud computing services impact positive on increase E-commerce sales. The development of cloud computing was caused information technologies to become an inexpensive public resource that is accessible to all people. Additionally, information technologies are not the core competency of an E-commerce enterprise, hence, an E-commerce enterprise can dealing more with management and business processes (Wang, 2013).

The rest analysed variables such as 3D printing and robotics, Artificial intelligence, Big data analysis and the Internet of things were not show statistical significance to the prediction of e-commerce sales, $p > 0.05$.

Conclusion

EU countries have successfully transferred their physical business operations on online E-Commerce channels while maintaining consumer demand during the COVID pandemic. The results obtained using the Multiple Linear Regression (MLR) indicates that cloud computing services the most contribute to E-commerce in COVID-19 time and improved the advancement of digital buying, and selling. These results have several theoretical and managerial implications. The EU policy should draft specific policies that direct all enterprises to use not only cloud computing services but also to intensify the use of other advanced digital technologies. With these findings, our study helps managers to improve their ICT structure and keep pace with the growing needs of the market.

Nevertheless of contributions, this study has some limitations that can provide motivation for additional research. This study analyzed data from 2020 on the EU countries, but in 2021 the world was still witnessing the spread of the COVID-19 pandemic. Due to the growing need for E-commerce sales, the results of this study can not confidently be generalized. Hence, the research model of this study could be tested in further research, targeting larger samples from other continents and markets to confirm these results.

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