

E-BUSINESS – A VIRTUAL BRIDGE BETWEEN ORGANIZATIONS AND CUSTOMERS WITH REAL RESULTS - A MATHEMATICAL VIEW

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Abstract. *In this new environment where the competition grow faster than ever before and the fight for attracting, retaining and gaining new customers became harder than ever, to survive in these conditions and to obtain competitive advantage, the organizations must adapt to different trends and challenges existing in this new environment. One of these challenges, on which organization must adapt, is implementing new technology, in order to satisfy customers' needs faster, cheaper and better. In this article, we proposed to present the evolution of e-business, and its advantages and disadvantages for organizations and for customers. We also developed a mathematical model, in which we show that there is a direct and positive relationship between e-business/e-commerce and some important factors having direct influence on these online processes.*

Keywords: *e-business, e-commerce, Internet, CRM, mathematical modeling, performance.*

1. INTRODUCTION

In today environment we can observe that e-business has entered into the society using Internet who became the backbone for much kind of businesses, offering dynamism into a virtual environment that became real business. The twentieth century will be remembered for the rapid changes in technology (Internet and www) and for the speed of development of new products, devices and gadgets [1]. The business community has been fundamentally changed by the advent of the Internet as a means of communication and trading. Organizations are using flexible networks to communicate and to do business [2], the world becoming smaller and more interconnected. People are staying more and more online [3].

In 1990 Internet was used for sending and receiving electronic messages and creating brochure ware-type applications, today companies are using Internet to extend their internal processes, protect their information assets, and improve the overall management of their enterprises [4].

In this article, we proposed to present the literature regarding the evolution of e-business, its role in the new virtual businesses, the advantages and the disadvantages of using e-business and to show that e-business is a powerful mechanism in simplifying the relationship between enterprises and customers, reducing costs for the both parties, and

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improve the relationships between stakeholders. We also developed a mathematical model, in which we show that there is a direct and positive relationship between using Internet by employees, and the enterprises (who use CRM and ERP programs and who have an attractive and an efficient website in order to attract and maintain online customers) and the enterprises that use e-business.

2. MATERIALS AND METHODS

2.1. ABOUT E-BUSINESS AND THE ROLE OF INTERNET IN DEPLOYING E-BUSINESS

We live today in a world much beyond of the dotcom bubble; it is a world in which even the most traditional businesses would not be without their online and telephone service channels, affecting every process by using operation automatization [5].

To understand the role of the Internet in business, we offer some definitions given by the specialists in the field: Internet is the last method developed in e-communication allowing ideas and information exchange at global level [6]; Internet tends to grow in being the most handy tool of global communication in the world [7]; Internet allows even small businesses to have global ambitions, and it places pressure on nations to relax regulations and cut taxes that make it more difficult for their businesses to compete [8]; Internet has a unique ability, that of be handy for everybody [9]; Internet is used in many fields: communication, human resources (recruitment and selection, development) [10], banking, booking, and business, customer relationship (which may be direct and indirect [11], or formal and informal [12]; Internet and e-mails, offers to the markets to connect and to become more powerful every day [13]; Internet has become, due to rapid world development, one of the most important media means that we can ever imagine [14]; Internet has developed a new virtual world offering images and movies, different information [15], and advertising [16] necessary for e-business, which is now a main stream part of most organizations [17].

The main features of an e-business are [17]: Makes greater use of electronic devices in the processing and communication data; Allows increased integration of databases and hardware devices; Enables users to engage „interactively” with systems and services to purchase goods, check on orders or collaborate in virtual teams or communities.

IBM defines e-business as „the transformation of key business processes through the use of Internet technologies” [18].

Realizing the full benefits of the Internet and as well of e-business is not easily done using traditional systems, therefore is needed the reinvention of their processing using Internet and new business models [17]. E-business is linked with the Internet and growth in the use and application of computers [19]. E-business innovations are digital transformation of business processes which results in a profound effect upon existing business practices. E-business innovations are about embracing change and changing rapidly. E-business uses the Internet, Intranets, extranets and other networks to support their commercial process and includes the process of transacting with suppliers and customers [1]. Using new technologies, the organizations are no longer perceived as individual entities but as part of an integrated network of organizations where ITC play a key role in smoothing transactions and collaborative ventures between partners [1]. Acceleration of globalization and informatization brought new activities: knowledge sharing, encouraging innovation and creativity, eliminates boundaries, integrated supply chains, facilitating global trade and creating wealth. In the developments in the e-business field, business and technology aspects are very strongly

interwoven. In many other fields, business developments create new requirements on technology. In other words: technology follows business [20].

So, the developments in e-business are driven by two concurrently operating forces that reinforce each other: a market pull force and a technology push force, both being strong and driven by the developments [21].

In the new economy, the markets become dynamic and complex, the competition become global and international, the organizations- virtual, the production- customized, and the customers tastes- dynamic, segmented [1]. These changes became real opportunities for business due to the development of the World Wide Web in the early 1990s that was the catalyst for huge changes in the business environment.

Successful e-business implementation begins with the creation of an appropriate structure for running an e-business project (Fig. 1) and must be designed to ensure successful delivery (in timely manner and within budget, and avoiding failure rates) [22].

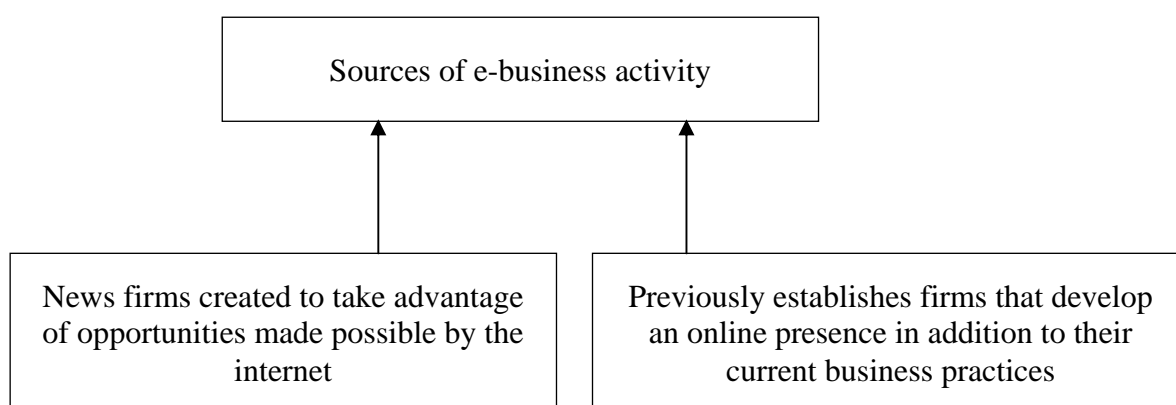


Figure 1. Sources of e-business activity.

The ready access to consumer information via the Internet and the web has empowered buyers and dramatically changed how many business transactions are conducted [23]. Access to the Internet and the web has created a business environment in which time and distance have less meaning, information has greater value, traditional intermediaries are being replaced or eliminated completely, and buyers hold more power than ever before. While buyers are enjoying greater access to markets, sellers are also finding tremendous advantages in doing e-business.

2.2. ADVANTAGES AND DIZADVANTAGES OF DOING E-BUSINESS

There are many and important advantages that e-business offer them for selleres, for buyers, for customers and also for the society. Among the important ones we remember: the Internet helped organizations to increase efficiency in their internal processes, such as: communicating with others, what to produce, how to deliver, and how they seek competitive advantage [1]; help organizations to satisfy faster and cheaper the consumers' needs [24]; simply to apply [18]; help increase profits, sales and decrease costs; can reach even small groups of customers all over the world; create virtual communities, increase sales/purchasing opportunity; identify new business partners, increase the speed and accuracy of information exchange; provide a wide range of choices, consumers may see the products 24 hours a day every day; one important reason to complement e-business is the company's desire to reach out to customers at greater geographic distances, having a shop front 24 hours a day, seven days a week, acquiring a new channel of business and integrated business processes [19]; e-business promotes a better company image, requires less floor space, leads to increased

accuracy of data and brings with it opportunities for more challenging responsibilities and training [19]; lead to increased productivity for customers and for employees by saving time and money [25]; communication is in convenient places and time through e-mail and other software; provides access to information anytime, anywhere, may be used to transfer some work to customers, releasing employees; allows to smaller markets to develop, serve customers from geographic dispersed areas; is an inexpensive mean to promote goods and services for potential customers; decreases costs, offers customized and personalized buying options [23]; access to narrow market segments, easy shopping, access to global markets, speed and accuracy of information delivery, data collection and customer preference tracking; e-business technologies provide a single mechanism to reach business, consumers, and employees with products and services across local, national and international boundaries in real time and at very low cost, simplifying business [22].

E-business offer beside many advantages, disadvantages too: the customers can not touch the products, thus tangibility has gone [29]; some products cannot be electronic traded [18]; the technology is rapidly changing; the delivery can be made by some firms only in certain areas; perishable products cannot be ordered online; requires specialized knowledge to use [3]; user must have Internet access; may be perceived as undesirable means of communications compared to direct contact between people; may result in lost customers or sales if online experience is unsatisfactory; online promotional efforts such as e-mail and pop-up advertising may be annoying and possibly counterproductive.

A SWOT analysis was made for a company, who make e-business (Table 1) to better understand its strengths, weaknesses, and the opportunities but also the threats that can appear into a turbulent environment and is presented below [18].

Table 1. SWOT analysis for an e-business process.

Strengths	Weaknesses
<ul style="list-style-type: none"> - Sell directly to consumers - Keep costs below competitor costs 	<ul style="list-style-type: none"> - No strong relationships with retailers
Opportunities	Threats
<ul style="list-style-type: none"> - Consumer desire for one-stop shopping - Consumers know what they want to buy - Internet could be a powerful marketing tool 	<ul style="list-style-type: none"> - Competitors have stronger brand names - Competitors have strong relationships with retailers

2.3. RESEARCH METHODOLOGY - ANALYZING THE IMPACT OF INTERNET ON ONLINE COMMERCE

We started our research departing from the following ideas: the use of Internet increased exponentially; the Internet is more and more used including in e-business and e-commerce; the virtual businesses became real businesses with real benefits (win-win for all implied); the e-businesses has the opportunity to create an attractive website to communicate better, to collaborate better, to inform more, to deliver rapidly, to satisfy cheaper the customer's needs, and other interested persons; the use of simulation and modeling bring performance. To show an insight of what we have just said, we show some data and information.

The Internet is evolving every year. Starting with 1996 when were 16 millions users in the world, in 2000 were 414.7 millions, in 2010 were 1.9 billions users and in 2016 were 3.6 billions users all over the world, and continue to grow [28]. „In a matter of very few years, the

Internet consolidated itself as a very powerful platform that has changed forever the way we do business, and the way we communicate” [29].

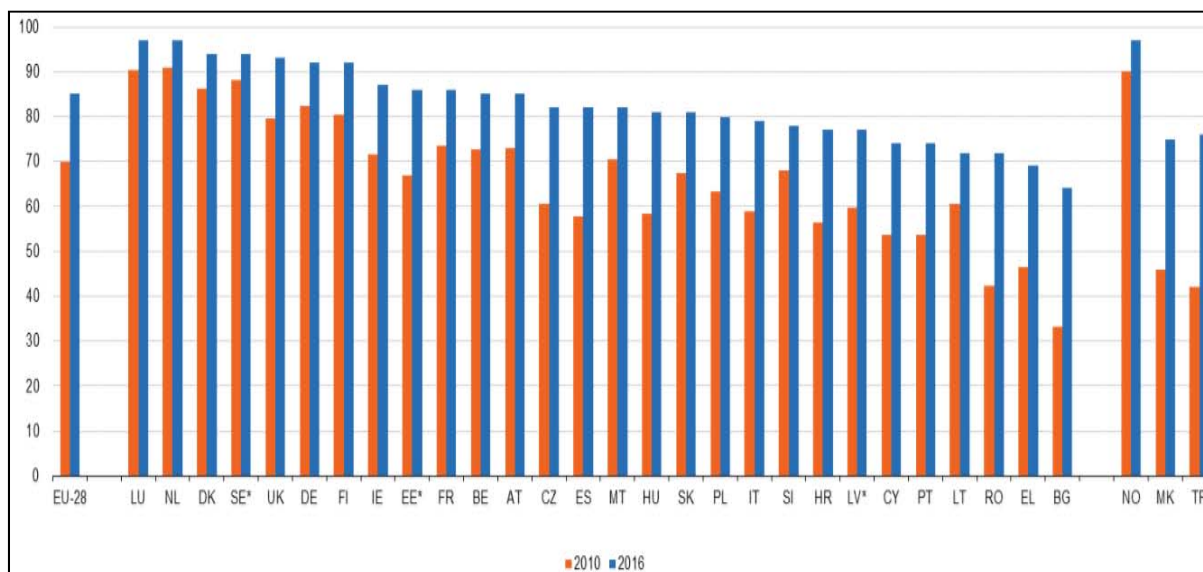


Figure 2. Households with internet access, 2010 and 2016 (as % of all households).

At EU-Member State level, the largest shares of households with access to the internet in 2016 (Fig. 2) were registered in Luxembourg and the Netherlands (97 % each), and the lowest proportions were registered in Bulgaria (64 %) and Greece (69 %) followed by Romania and Lithuania (72 % each). Between 2010 and 2016, significant increases (about 30 percentage points) in the share of households connected to the internet were observed in Bulgaria and Romania, though still remaining at the lower end of the scale [30].

The customer needs that are satisfied by Internet firms may be unique to the Internet environment [25]. E-business success is depending also by the firms website, which can provide a wide assortment of opportunities for communicating with customers, investors, suppliers, and other interested public groups. A successful designed website can provide a high level of personalized communication between the website sales presentation and the customer. A well-informed customer is making him powerful and confident [25].

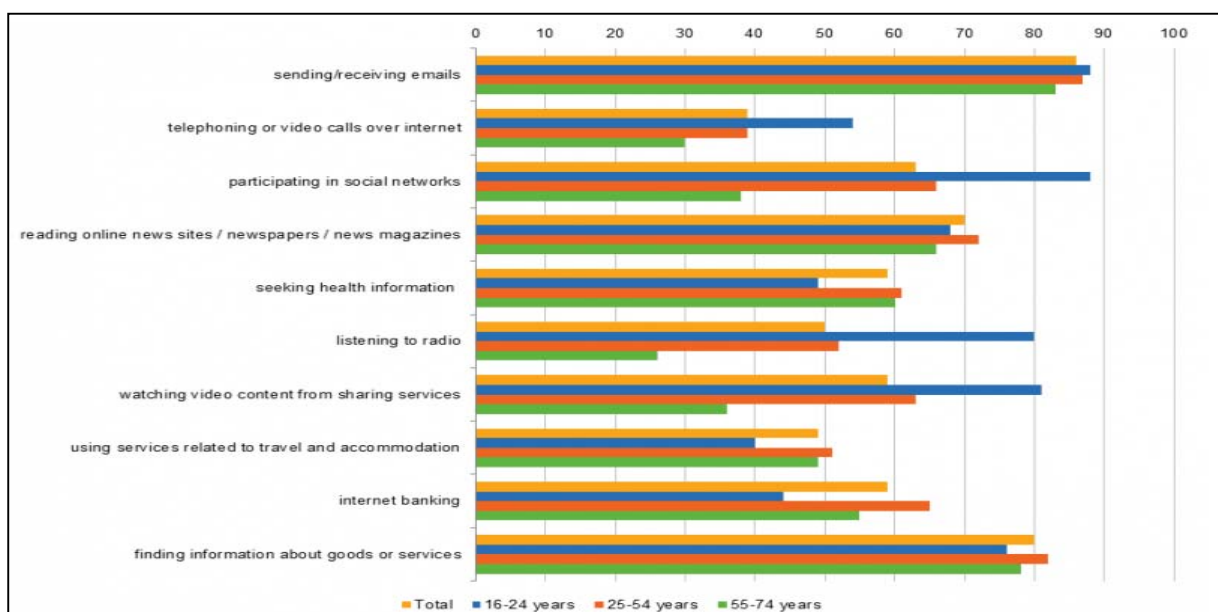


Figure 3. Internet activities in the past three months by age group EU-28, 2016 (% of internet users).

We may observe (Fig. 4) that communication by e-mail and finding information about goods and services are the most popular activities carried out in internet. On average, 86 % of European internet users aged 16-74 have sent and received e-mails for private purposes and 80 % have searched for information.

3. RESULTS AND DISCUSSION

3.1 CASE 1

Main objective- to analyse if there is a direct and positive relationship between the analysed variables and e-business.

Used tools - We are using the prediction method on long term, using a model of multifactorial regression OLS (and Eviews 7.0) in order to reduce costs, increase performance [26] and to observe the influence certain independent variables could have on a dependent variable. We also used Descriptive statistics, and Correlation Matrix. This method is the regression function and offers a view regarding this relationship [31].

We started from the multifactorial regression equation [32, 33]:

$$y = a + b_1 \cdot x_1 + b_2 \cdot x_2 + b_3 \cdot x_3 \quad (1)$$

where: y represents dependent variable (is considered the e-business), a - free term (the intercept); b_1 - b_3 represent regression coefficients (the slope); x_1 - x_3 represent independent variables as (x_1 -enterprises using CRM and ERP programs, x_2 - use of PC and Internet by the employees, x_3 - enterprises with an website necessary for e-business).

Data about these analysed variables were collected from the official site of eurostat.com [34]. Data were available for 28 European countries (Table 2).

For the purpose of this study, the following hypotheses were established in order to be analyzed:

H1- There is a direct and positive relationship between e-business and the proposed variables.

H2- There is a normal distribution among the analyzed variables.

H3- There is a correlation between the analyzed variables.

Table 2. Variables influencing e-business.

Year	Enterprises adopting technologies for e-business (y)	Enterprises using CRM or ERP in e-business (x_1)	Use of PC and the Internet by employees (x_2)	Enterprises with an website necessary for e-business (x_3)
2010	94	21	52	67
2011	95	22	53	69
2012	95	22	53	71
2013	96	26	54	73
2014	97	31	52	74
2015	97	36	54	75
2016	97	41	55	77

We represent the analysed data (Fig. 4) using the simple graphical representation in Eviews.

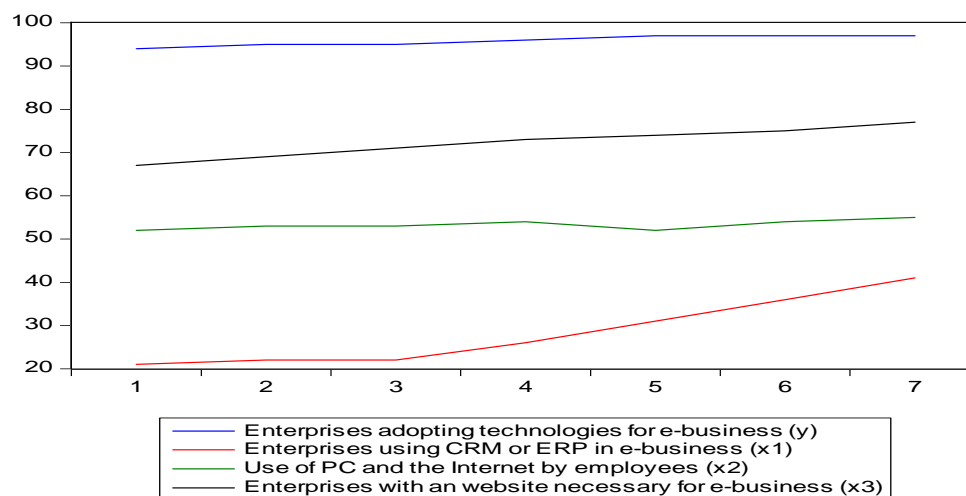


Figure 4. The graphical representation of analysed variables - calculation made by the authors using Eviews.

Using OLS method

The coefficients of the analyzed variables can be estimated by using the OLS method. Using Eviews 7 we may observe the relationship between e-business and the three analysed variables (Table 3).

Table 3. The relationship between analyzed variables.

Dependent Variable: E_BUSINESS				
Method: Least Squares				
Included observations: 7				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
x_1	0.015618	0.053255	0.293266	0.7884
x_2	-0.311380	0.203141	-1.532825	0.2229
x_3	0.368259	0.123488	2.982153	0.0585
C	85.38539	10.85497	7.866015	0.0043
R-squared	0.947995	Mean dependent var		95.85714
Adjusted R-squared	0.895990	S.D. dependent var		1.214986
S.E. of regression	0.391840	Akaike info criterion		1.259632
Sum squared resid	0.460616	Schwarz criterion		1.228724
Log likelihood	-0.408714	Hannan-Quinn criter.		0.877609
F-statistic	18.22893	Durbin-Watson stat		3.054371
Prob(F-statistic)	0.019816			

The estimation command in Eviews is:

$$\text{LS E_BUSINESS C } x_1 x_2 x_3 \quad (2)$$

Estimation Equation:

$$\text{E_BUSINESS} = \text{C0} + \text{C(1)} * x_1 + \text{C(2)} * x_2 + \text{C(3)} * x_3 + \text{C(4)} \quad (3)$$

Substituted Coefficients:

$$E_BUSINESS = 85.38 + 0.0156 * x_1 - 0.3113 * x_2 + 0.3682 * x_3 \quad (4)$$

The estimated model is statistically significant at the .01 level ($F = 18.22$; $p = 0.019$). Furthermore, the coefficient of determination, adjusted for degrees of freedom, R^2 is equal to 0.947.

According to some specialists in the field, when R is 0 there is no relationship between the analyzed variables, when is between (0-0.3) is a weak relationship, when is between (0.3-0.5) is a low relationship, (0.5-0.7), between (0.7-0.9) is a high relationship, between (0.9-1) is a very high or strong relationship and 1 is a perfect relationship [8, 33, 35, 36]. Between the analyzed variables, we observe that there is a positive, direct, and very high relationship ($R^2=0.947$); Adjusted R-squared (0.895) is indicating that about 89.5% of the variation in the dependent variable, e-moderate relationship, business, is collectively explained by the three analyzed variables. The regression model shows that the free term is positive and has a large value (85.38) and an increase of 1 point in the e-business will lead to an increase by 0.0156 points for x_1 , a decrease by -0.3113 points for x_2 , and an increase by 0.3682 for x_3 .

R-squared is 0.947, resulting that R is 0.973, concluding that between e-business and the analyzed variables there is a strong, direct and positive relationships (being almost equal to 1). Thus, the hypothesis **H1- There is a relationship between e-business and the other analyzed variables** is accepted.

Descriptive statistics

Table 4 provides descriptive statistics (mean, standard deviation, minimum, maximum, Std. Dev, skewness, kurtosis, Jarque-Bera) for the variables considered, using data from eurostat.com between 2010-2016 at EU28 level.

Table 4. Descriptive statistics for analysed variables (2010-2016).

	E_BUSINESS	x_1	x_2	x_3
Mean	95.85714	28.42857	53.28571	72.28571
Median	96.00000	26.00000	53.00000	73.00000
Maximum	97.00000	41.00000	55.00000	77.00000
Minimum	94.00000	21.00000	52.00000	67.00000
Std. Dev.	1.214986	7.807201	1.112697	3.498299
Skewness	-0.319549	0.560733	0.192012	-0.231696
Kurtosis	1.614464	1.821494	1.856509	1.891543
Jarque-Bera	0.679045	0.771914	0.424388	0.420995
Probability	0.712110	0.679800	0.808808	0.810181
Sum	671.0000	199.0000	373.0000	506.0000
Sum Sq. Dev.	8.857143	365.7143	7.428571	73.42857
Observations	7	7	7	7

The summary statistics is necessary to analyze the sample during the period remembered. All the analyzed variables present a positive mean value. The mean for y has the largest value (95.85). The range of variation between maximum and minimum is quite logical. We observe in the table above that for all data series, the mean and median have very similar values, the ratio between mean and the median of each variable being approximately 1.

The standard deviation compared to the mean is very low which not indicates coefficient of variation. Also, the sum squared deviation row represents the net change over the sample period. It shows that x_1 and x_3 increased very much, while for other variables increased insignificantly. Also, the standard deviation (Std. Dev.) of data series has small

values for all the variables and therefore it can be considered that the series are relatively homogeneous. In terms of skewness, the results for variable y and x_3 are negatively skewed while for variable x_1 and x_2 indicate a positive skewness.

The value for kurtosis in each variable is between 1.61 and 1.89 being below the benchmark for a normal distribution of 3, which is positioned near normality. It is important to show that all the values of kurtosis are smaller than three, but bigger than 0, making the distribution Leptokurtic and the values concentrated around the central tendency. Thus, the analyzed variables are characterized by a normal distribution.

The values obtained for Jarque Bera test are between 0.42 and 0.77 (indicating that all the variables are approximately normally distributed), having associated probabilities between 0.67 and 0.81 indicating that the variables are not volatile. The Jarque-Bera (JB) values show that all the sample indices were normally distributed. In other words, all the sample indices were less volatile during the analyzed period. Thus, the distribution of all the sample indices was normal. So, the hypothesis H2-*There is a normal distribution among the analyzed variables*, was accepted.

The correlations between the analyzed variables

The inter-correlations among the four analyzed variables including the dependent variable e-business are shown in Table 5. According to the results, the values of correlation are all strong and positive and ranged from 0.528 to 0.952. The strongest relationships are between y and x_3 (0.952), between x_1 and x_3 (0.922), between y and x_1 (0.886), between x_2 and x_3 (0.703), between x_1 and x_2 (0.674), and the weak relationship but above the average is between y and x_2 (0.528). The following calculations show the correlations among the analyzed variables.

Table 5. The correlations between variables.

	E_BUSINESS	x_1	x_2	x_3
E_BUSINESS	1			
x_1	0.886	1		
x_2	0.528	0.674	1	
x_3	0.952	0.922	0.703	1

From these calculations results that the hypothesis **H3- There is a corelation between the analyzed variables**, was accepted, thus between the analyzed variables do exist only direct, strong and positive correlations.

3.2 CASE 2

Main objective- to analyse if there is a relationship between e-commerce sales and Internet use by individuals.

Used tools- We are using Pearson coefficient and Excel-DataAnalysis in order to observe the relationship between the two analysed variables.

Data were gathered from European level average (EU-28) between 2010 and 2017 and the analysed variables are: y (dependent variable)-value of e-commerce sales; x (independent variable)-Internet use by individuals, and we want to show that between using the internet and e-commerce sales is a direct and positive relationship (Table 6).

Table 6. Data about e-commerce sales and Internet use by individuals.

Year	Value of e-commerce sales (y)	Internet use by individuals (x _i)
2010	14	68
2011	14	71
2012	15	73
2013	14	75
2014	15	78
2015	17	79
2016	16	82
2017	18	84

Starting from the multifactorial regression equation: $y = a + b \cdot x$ is obtained the following Summary Output (Table 7).

Table 7. Results of data analysing using Excel-DataAnalysis.

<i>Regression Statistics</i>						
Multiple R			0.847345			
R Square			0.717993			
Adjusted R Square			0.661592			
Standard Error			0.879491			
Observations			7			
ANOVA	Df	SS	MS	F	Significance F	
Regression	1	9.846764	9.846764	12.73007	0.016079017	
Residual	5	3.867521	0.773504			
Total	6	13.714290				
	Coefficients	Standard Err	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-5.44017	5.898404	-0.92231	0.398686	-20.6025	9.7221581
68	0.271368	0.076058	3.567923	0.016079	0.07585531	0.4668797

We may observe that there is a direct and positive relationship between the analysed variables, thus $R^2 = 0.71$ shows that there is a high relationship, and 66.15% from the evolution of y is explained by the evolution of x. ANOVA represents the analysis table of the variance [39] (Table 7).

In this case the regression equation is:

$$y = -5.44 + 0.27 \cdot x \quad (5)$$

The intercept or the free term is negative and has a low value (-5.44) and it is simply the value at which the fitted line crosses the y-axis. The slope is positive and measure the change in dependent variable [37] - e-commerce and an increase by 0.27 points for independent x will lead to an increase of 1 point in the e-commerce. Lower 95%, Upper 95% – upper and lower limits of the confidence interval for the parameter. The limits for 0.05 are calculated automatically, regardless of the initialization procedure Regression. It could be said that the linear model parameters are within the following ranges:

$$-20.6 < a < 9.72 \text{ and } 0.07 < b < 0.46 \quad (6)$$

As we may observe, new technologies and internet helped organizations to satisfy easier the consumers' expectations and support better the organization processes [41]. Research presented in this paper shows that: **for the first case**, the analyzed variables: enterprises using CRM and ERP solutions use of PC by the employees, and enterprises with an effective website have a significant impact on the e-business.

First, the role of the website on e-business is not surprising (0.952) because, is representing the gate through the enterprise, the window to see the organization, offering information about itself, about its customers, its products and services, about its prices, about its regulations and politics, and other data and information necessary to attract, retain and grow the future and the present customers and interested persons. Second, the use of PC is very important for e-business (0.528), because only if you know to handle a computer, the process of buying or purchasing may take place. In the world, the rate of detaining a PC we see is not so high, so it is a future opportunity to grow e-business by increasing the access to a computer and to improve people e-skills. Third, the enterprises using CRM and ERP solutions positively affect e-business evolution (0.952). This is not surprising as the new customers from the new markets tend to be faster and sustainable satisfied, entrepreneurial, taking risks, trying new things, and having a strong desire for using the new technological innovations.

For the second case, the analyzed variable: Internet used by individuals has an important influence on e-commerce. The value obtained for R^2 is high enough to influence the online commerce (0.71). The research findings may have many implications for researchers, practitioners, policy makers and specialists from different fields using ITC systems and acting on international markets who must analyze different factors which influence e-business: economic and cultural dimensions, social and political ones, the buying customers behaviors, the attitude, the level of education and the degree of knowing to handle a PC. They must also take into consideration that there is a difference between the technology users, which may vary from one country to another due to incomes, acceptance, values, economic or cultural differences.

4. CONCLUSIONS

E-business is a new mechanism for businesses in the modern era, where virtual technologies help obtaining real performance and satisfy real needs. The customers desires are evolving every day, the e-skills of customers and employees and the new technologies the same way, thus, the e-business became a solution to traditional business. E-business is not trying to replace the traditional business; it is a completion to this, to satisfy the customers' needs faster, cheaper and better. In a global market, where informatization, liberalization and digitization are every step, e-business, may bring better collaboration, communication, competitive advantage even for small firms. E-business offered a new way for dealing with new business partners and new customers, bringing reduced costs, activity 24/7/365, access to new skills and technologies, continuous access to data, information and monitoring, improving all activities. Besides these benefits there are some disadvantages too, but, with a powerful and effective management, with employees open to change and to challenges, e-business may become a solution for any person who want performance.

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