

THE ROLE OF MATHEMATICAL MODELING IN ANALYSING THE IMPACT OF THE INTERNET ON COMMERCIAL ACTIVITIES

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Abstract. *Globalization, liberalization of markets, internationalization and Internet has led to new open visions and business opportunities. Now, large and small businesses may have business relationships all over the world and obtain many important advantages such as: rapid transfer of information, rapid connectivity, diversity, interculturality, finding new knowledge, experiences, and values, and lower costs for communication and collaboration, anytime, anywhere. In a world where many activities are now online, why not the commercial activity to not be online? The Internet, as the newest direct marketing technique, has led to increased sales made online. The customers and the organizations, make purchase and sale online, known as e-commerce. In this article we analyse the role played by the Internet in commerce activities, implementing mathematical modeling and simulation to show their implication in commercial activities and to show there is a direct and positive relation between the Internet and the commercial activities.*

Keywords: *e-commerce, mathematical modeling, simulation, performance.*

1. INTRODUCTION

In the new digitized work world the speed, the cost and the novelty of transmitting information is vital for any organization. Internet helps organizations to share rapidly information using computers and e-skills of employees. 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 [1].

The Internet as is showed below has many advantages, but as well it has an important disadvantage: reduces the level of face-to-face contact with customers [2], creating a psychological and a spacial distance. Digital economy provides a vast array of digital products, digital transactions, digital currencies, and physical goods with processing and networking capabilities. Manzoor A. says that the digital economy creates a digital economic revolution and web-based e-commerce systems which accelerates the digital revolution [3]. This provides competitive advantage, performance, challenge, strategic advantage, but also offered many risks and pressures with impact on environment, organizations and employees.

To remain competitive, the organizations must respond to many pressures, such as: market and economic pressures, societal pressures (social responsibility, sustainable development, equity, ethics), technological pressures, and find some competitive responses by using strategic alliances, electronic markets, development of the talented employees, new solutions in customer relationship management (CRM) field, customizations for customers

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needs, lower costs, improved quality, new facilities for customers, innovative solutions, new products, new qualitative services.

E-commerce has the role in sustaining these responses. Rapid growth in technology offers organizations new ways to respond these challenges from external environment, offering a large variety of more and more complex systems [3].

Internet helps organizations to get new markets at lower costs, to understand customer needs better, to develop more customer-centric programs for satisfying needs, offer enhanced value through managing customer information and needs, and provide customized products and services.

As several authors [4], the Internet, as a new technological tool, adds greater value to CRM, by making the various stages and strategies of CRM more cost-efficient, enables identification of customer or just of visitor, offering cost-efficient data collection, personalization, customization and interactivity.

2. MATERIALS AND METHODS

2.1. MATERIALS

The Internet- evolution and implication in commercial activities

Due to rapid global increasing, the Internet has become one of the most important media tools that we can ever imagine [5]. The world became interconnected and smaller, thus the globalization can not be a phenomenon which can be ignored. Global communication and collaboration was helped by the advancements of technology: the Internet, the Intranet, e-mail, fax, and mobile phones [6] being a major factor who led to increased globalization, especially in communication [6]. Even the small enterprises has now the opportunity to collaborate with large organizations or with customers from different geographical areas [7]. The digital impact is the new way for making the present businesses [8] and e-communication (in a world of online businesses) is the backbone of all the organization processes [8]. The PCS and the Internet have changed many aspects of our lives. People are now staying much time online [9].

As it is seen in Table 1 the evolution of Internet over the years has known an important increasing between 2000 and 2017 (its growth being of 933.8%), but the penetration rate is stil lower (49.6%); still, the Internet has bring its benefits in many aspects of our lives and in many activities: e-auctioning, e-directories, e-engineering, e-franchising, e-gambling, e-learning, e-marketing, e-supply, e-trading, e-banking, e-booking, e-gouvernement, e-recruitment, e-selection, e-development (e-coaching, e-mentoring), e-communication, e-commerce and so on.

Table 1. Number of persons who use the Internet (2000-2017) (billions)

Years	2000	2010	2012	2014	2016	2017
Internet users	0.360	1.966	2.405	3.035	3.611	3.731
Penetration rate	6.8%	29.2%	35.1%	40.7%	46.1%	49.6%
Growth	-	444.8% (2000-2010)	566.4% (2000-2012)	741% (2000-2014)	900.4% (2000-2016)	933.8% (2000-2017)

Source: adaptation after www.internetworldstats.com, www.internetlivestats.com/internet-users.

Using new technologies, people and organizations can benefit of:

- reduced costs, help people to interact rapidly and direct or indirect [10],
- improved communication within community, groups and families [11],
- better connectivity with different persons from different places,
- improved promotion of ideas dissemination [10],
- improved information flow being free,
- quicker solve of certain issues,
- access to education (online education or e-libraries) [10],
- access to information from different fields: health, social, economic, political,
- gain new information, knowledge, skills, create relationships [11].

But there is a reverse of using these new technologies such as:

- lack of skills necessary for their use [10],
- lack of experience,
- may complicate life, relationships or to increase tensions [11],
- may affect the communication with close persons,
- may low the work jobs due to automatization and to lead to dehumanization of work markets [12].

New technologies have the role to improve the need for development, education, information, improve the living level and bring peace. New virtual markets have begun to develop, and implicitly to co-develop some institutions that produce value [10]. The commerce and the delivery agents implied in these processes can be traditional or physical digital and virtual (e-commerce) and its dimensions are presented in the figure below Fig. 1).

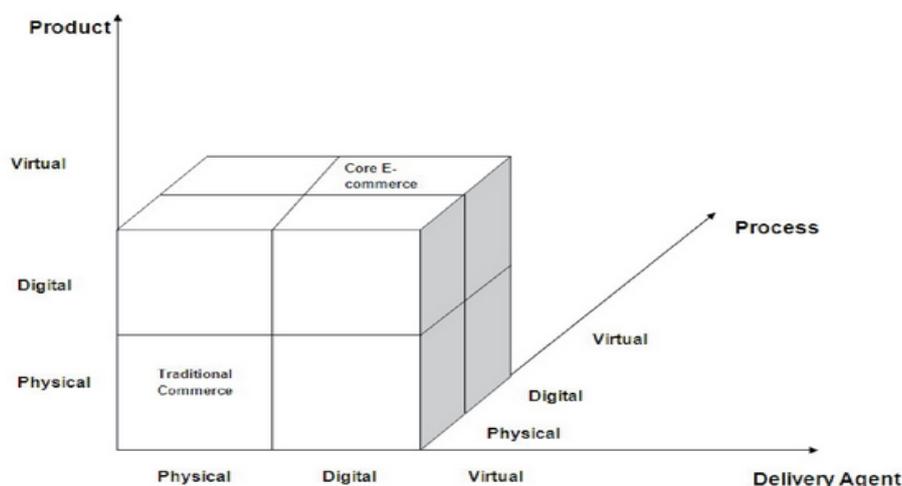


Figure 1. Dimensions of e-commerce [3].

As we may observe, at the intersection of virtual product and the virtual delivery the commerce can have e-commerce activities. To understand better this activity, the specialists have classified the forms of e-commerce, forms presented in Table 2.

Table 2 Forms of business in e-commerce [3]

Forms of e-commerce	Description
Brick and mortar business	Old-economy business that perform most of its business off-line. They sell physical products using physical delivery agents.
Click-and-mortar business	Organizations that conduct some of their business activities online but do their primary business in the physical world.
Virtual business (pure-play business)	Organizations that conduct their business activities solely online.
Electronic market (e-marketplace)	An online electronic market where buyers and sellers meet to exchange goods, services, money, or information.

E-marketplaces are classified on the basis of their ownership: private (trading platforms set up by individual companies), public (B2B markets that are own by the third party), independent, and consortia (established by the third parties distinct from the e-marketplaces targeted buyers and sellers) [3].

The term E-commerce was first introduced in the early 1990s. Over the last three decades e-commerce has transformed. E-commerce applications were first developed in the early 1970s and used by large corporations. Starting in mid 90s, many innovative applications developed ranging from online direct sales to e-learning experiences. These applications may now be used by any type of organizations, having any size, by any employee, business partner or public institution.

E-commerce has known two phases of development [3]:

- First phase- 1995-2000- dominated by companies operating in USA (web pages were primarily in English, particularly on commerce sites; enjoyed easy access to start-up capital but used slow and inexpensive Internet technologies; e-mail was used for relatively unstructured communication; simple online advertising; didn't have ways to distribute digital products on web),

- Second phase- from 2000 onwards- is international in its scope (with global enterprises doing business in many countries and in many languages; the speed increased, and the integrated communication systems that allow companies to communicate each other, share transactions, and customer demand information effectively; e-mail was used as an integral part of marketing and customer contact strategies of the companies; multiple sophisticated advertising approaches; various new approaches for legal distribution of digital products on web).

Sometimes the terms e-commerce and e-business are used interchangeably but they are distinct concepts. E-commerce is used to describe the process of transacting business over the Internet; and it is easy to implement, and e-business involves the fundamental reengineering of the business model into an internet based networked enterprise, including any process that a business conducts using internet. The difference between them is the degree to which an organization transforms its business operations and practices through the use of the internet.

E-commerce refers to the use of electronic means and technologies to conduct commerce (sale, purchase, transfer, or exchange of products, services, and/or information), including with business, B2B, B2C interactions. E-commerce is easy to implement compared with e-business, because it involves [13]:

- vertical integration of front-end web site applications to existing transaction systems,
- cross-business integration of a company with web sites of customers, suppliers or intermediaries,
- integration of technology processes for order handling, purchasing or customer service.

E-commerce is more than just retailing over the Internet, it relates to the production, advertising, sale and distribution via telecommunication networks [14].

During 2015, one out of five enterprises in the EU-28 made electronic sales. The percentage of turnover on e-sales amounted to 16 % of the total turnover of enterprises with 10 or more persons employed [15].

There are some internal and external factors that help organizations to obtain competitive advantage. Among the external factors is also the internet usage, which is an important factor fueling the e-commerce worldwide [3]. The increased number of people who use internet and the desire to buy/sell online contributed to the increased evolution of e-commerce.

Current trends in e-commerce technologies generally focus on developing technologies that reduce costs considerably and provide in capabilities, ease of use, increased availability of software, ease of site development, and improved security and accessibility

E-commerce may offer services such as [16]:

- services provided via voice telephone, fax, or telex,
- exchange of information by e-mail,
- certain television broadcasting services,
- radio broadcasting services,
- televised teletext and other equivalent services.

To improve e-commerce activity, the organizations may use some indicators who will help specialists to improve their activity and attract more customers [17, 18]:

- summarize of all visitors activity from an existing key account, finding what the interest of the customer is,
- observe the customer reactions about the product, the service, the site, the organization,
- find out their questions,
- identify the profile of the customers and the future customers,
- collect important data about the customers and make a database (the way he pay, the money spend, the amount, the frequency, the recency).

To obtain a successful e-commerce activity, the organization must:

- create a social media plan focused on determining where, when, and how to interact with the customers [19],
- conduct an efficient social networking,
- decide which sites to use in order to attract and retain customers,
- decide which approach it will take,
- create an online strategy (think social marketing, leverage the secret ingredient: trust, listening the customer, add value, offer authenticity, transparency, recruit the right sales force, target the coveted influentials, find out what the customers feel about the advertising campaigns, create a magnetic engagement with the brand, Accept the negative comments, find real and efficient solutions, respond quickly if there is any crisis) [20],

- monitor the online activity by calculating different efficiency indicators (calculate the popularity of the brand by determining the number of fans, visitors, and friends, number of followers, number of subscribers, members, calculate the social interaction rate and determine if the customer is actively engaged [20] and calculate the number of comments, the number of tweets or retweets, the number of posts or reposting, and the number or percentage

of comments in response to photos, videos and posts on blogs, or related social communities, calculate the costs using the cost per fan, friend, follower or member, cost per comments or tweets, and the cost per brand perception lift, and calculate the ROI because according to a study it is very difficult to determine and to measure the exactly value brought by this activity

- create an attractive platform to challenge the online buyer to choose for e-commerce (this document describes messages, style, tone, and creative constraints for copy and visuals that apply across all materials for a product campaign; it defines the range of flexibility, determine the audience profile, create the brand messages, determine the campaign themes, the writing and the presentation style (headlines, subheads, bullet lists), the tone, the colour, size, font, other formats the constraints, and the evaluation criteria [21].

Benefits and disadvantages of using Internet to buy and to purchase online

E-commerce provides significant benefits to the economy and the consumers:

- offers enhanced capacity to research and compare products [3],
- offers expanded choice in products that may be purchased at any time and from anywhere,
- offers more possibilities to customize products to better meet personal preferences,
- offers transparency which will intensify competition and oftentimes results in lower prices for consumers,
- serves as an equalizer by enabling start-up and small- and medium-sized enterprises to reach the global market,
- may distribute products to distributors who are geographically dispersed but who are connected to each other via computer networks,
- acts as a change for consumers,
- allows consumers to shop or perform other transactions from anywhere in the world round the clock 365 days a year,
- allows for many innovative business models and reduces the time between the inception of an idea and its commercialization,
- makes simpler the processes, increases processes flexibility, reduces cycle time and provides new business partners,
- reduces variable cost per unit and will increase returns and sales,
- offers the opportunity to small businesses to make low transactions costs.
- can reach to any company, offering different information and services,
- provides advantages to the society: more individuals work from home, reduce travelling costs, reduce the traffic on the roads,
- improves quality in public services due to reduced costs in health care, education, and distribution in government social services,
- improves resource allocation time [22],
- offers product cost savings,
- reduces negotiation time,
- improves employee morale,
- increases accuracy,
- improves response times,
- offers effective communication and collaboration,
- provides faster information exchange,
- improves production planning, material purchasing, and inventory management,
- shortens the design processes, design cycles, introduce new products that better match customer tastes, gain higher market share, increase profitability,
- eliminates manual processes,

- increases frequency,
 - provides new online capabilities [23],
 - builds trust in online transactions,
 - creates business value,
 - leads to trading partner satisfaction (improved image, reputation) [24],
 - offers better and open communication, information sharing, commitment,
 - improves customer service [25],
 - create new products and services,
 - improves quality information and internal control [26],
 - forces companies to adopt new technologies, create new business structures, and customize their products [27],
 - improves technology and organizational learning, change work culture, create new business models,
 - offers global reach, reduce costs (for marketing, telecommunication) and inventories,
 - finds new business partners, faster access to information,
 - increases choice of vendors and products,
 - offers the opportunity for convenience of shopping at home, more competitive prices and increased price comparison capabilities,
 - offers quick delivery of digitized products and services,
 - provides virtual auctions for buying and selling,
 - offers the possibility to start a business in an unconventional way [28],
 - allows the new entrepreneurs to open a new business with little money, experience and grow rapidly,
 - offers supply chain improvements, efficient procurement, help SME to compete,
 - offers the opportunity for the customers to shop comfortable, to find bargains or unique items, for social interaction,
 - offers the opportunity for society to improve telecommuting, to offer more public services, improve homeland security, to increase standard of living, and to close the digital divide,
 - builds brands, provide portals and virtual communities [29],
- E-commerce may also bring some disadvantages which are due:
- to the fact that technology is new and rapidly changing [3],
 - to different existing business language,
 - to risks such as legal and taxation environment,
 - to not recruit the right skills of employees,
 - to difficult software integration,
 - to existing standards in quality, security or reliability,
 - to existing risks (in technology, relational conflicts), privacy problems (violation of personal data), and security flaws [24],
 - to mismatch between the expected e-commerce criteria and actual e-commerce benefits [26],
 - to the triviality of time, effort and investment made to implement e-commerce,
 - to channel conflict, competition, copyright, customer acceptance, legal issues, loyalty, pricing, security, lack of trust, accessibility [27].

2.2. METHODS

We started our research from the following facts:

- the Internet is more and more used in personal daily life, and also in commercial activity,
- the e-commerce knew an increased growth due to new technologies and the e-skills development,
- the interest in selling and purchasing online increased year after year for organizations and also for customers.

So, our main objective is to show the role the Internet has in increasing the interest in e-commerce and the relationship between using Internet and some variables which will analyse below. We will use mathematical modeling and business simulation to show this relationship (Spearman test, Anova test, and Eviews7 program). In this article secondary data were used for a period of 13 years between 2005 and 2016. We analyse data from the European level (EU 28), data collected from eurostat.com.

2.3. ANALYSING THE TREND OF E-COMMERCE, E-SALES AND E-PURCHASE ON EUROPEAN LEVEL

For start, we present some data regarding the trend of e-commerce in the EU countries. In 2015, enterprises from the European Union (EU) made 16% of their total turnover from e-sales, compared with 17% in 2014 and 12% in 2008. In 2014, e-purchases (40%) were much more than e-sales (19%) (Fig. 2). Highest values from e-sales were obtained in Ireland and the Czech Republic. In the same year, e-purchases were made by more than half of enterprises in Austria (68%), the Czech Republic (56%), Germany (54%), Finland and the United Kingdom (both 51%), while for e-sales, the share was lower in every Member State [15].

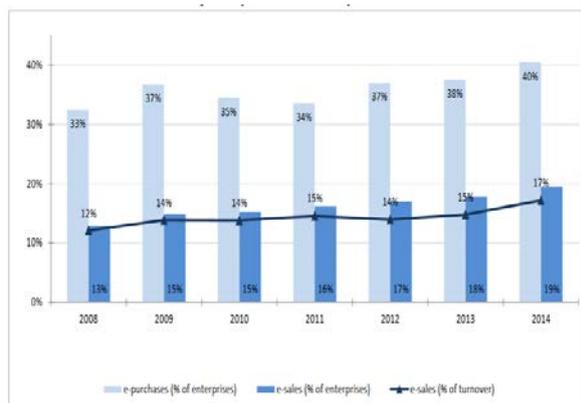


Figure 2. E-commerce by enterprises in the EU28 (2008-2014) [15].

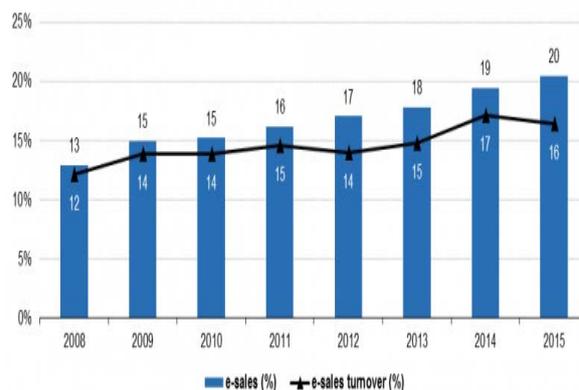


Figure 3. E-sales and e-sales turnover EU28 (2008-2015) [30].

As for e-sales, Ireland registered the highest share (37% of total turnover of enterprises), Czech Republic (30%), Slovakia, Finland and the United Kingdom (all 21%). At the end of the scale are enterprises from Greece (1%), Bulgaria (5%), Cyprus (6%) and Romania (8%). The lowest values for e-purchases are in Greece with 11%, Bulgaria with 13%, and Romania with 14% .

In the EU-28, during the period 2008 to 2015, the percentage of enterprises that had e-sales increased by 7 percentage points whereas the enterprises' turnover from e-sales increased only by 4 percentage points (Fig. 3). During 2015, 42 % of large enterprises made e-sales (23 % of total turnover in this size class), 28 % of medium sized enterprises made e-sales (12 % of total turnover in this size class), and 18 % of small enterprises engaged in e-sales (6 % of the turnover of such enterprises).

Table 2. E-sales and turnover from e-sales, by size class, 2011 to 2015, EU28 [30]

	Enterprises with e-sales (%)			Enterprises' turnover from e-commerce (%)		
	2011	2013	2015	2011	2013	2015
All enterprises	16	18	20	15	15	16
Large	39	40	42	21	20	23
Medium	24	25	28	11	11	12
Small	14	16	18	5	6	6

As Table 2 shows, there was a significant variation in the share of enterprises conducting e-sales and the turnover from the e-sales according to enterprise size.

In 2015, among the EU-28, the percentage of enterprises making e-sales ranged from 7 % in Romania to 30 % in Ireland, followed by Denmark (29 %) and Germany and Sweden (28 %).

During 2015, 80 % of EU enterprises selling electronically used a website or apps, while 32 % used EDI-type sales. On the one hand, during 2015, the percentage of enterprises that used EDI-type sales ranged from 13 % of enterprises conducting e-sales in Greece to 49 % in Ireland, followed by the Czech Republic (46 %). On the other hand, the percentage of enterprises receiving orders over websites or via apps was considerably high for almost all Member States, ranging from 72 % in Portugal to 95 % in Greece.

3. RESULTS AND DISCUSSION

3.1. ANALYSING THE RELATIONSHIP BETWEEN USING INTERNET AND E-COMMERCE AT EUROPEAN LEVEL

To observe the relationship between the Internet and e-commerce activities, are presented two situations:

- case 1- where the situation is presented at enterprises level (using data from EU-28 level),
- case 2- where the situation is presented at individuals level (using data from EU-28 level).

For the two situations are used data between 2004 and 2016.

The regression function and Eviews7 program are used to observe and analyse the relationship between the analysed variables.

Case 1

In this case will be used the following variables:

- dependent variable: Enterprises with broadband access as being considered enterprises which use internet for e-commerce,

- independent variables: Share of enterprises turnover on e-commerce, Enterprises having received orders online, Enterprises having purchase online.

Research Hypothesis

H1- There is a direct and positive relationship between the analyzed variables,

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

H3- There is a correlation between the analyzed variables.

H4- There is a normal distribution for residuals.

The data are collected from EU28 between 2004 and 2016, and is used regression function in order to analyse the impact could have some independent variables established above (Table 3) on enterprises who use internet in their commercial activities.

Table 3. Data about analysed variables between 2004-2016 (EU28 level) [15].

Year	Enterprises with broadband access (y)	Share of enterprises turnover on e-commerce (x1)	Enterprises having purchase online (x2)	Enterprises having received orders online (x3)
2004	62	10	26	12
2005	62	10	24	12
2006	73	11	28	14
2007	77	11	29	15
2008	81	12	28	16
2009	83	13	24	12
2010	85	14	23	13
2011	89	14	23	13
2012	92	15	23	14
2013	93	14	23	14
2014	94	15	22	15
2015	95	17	24	17
2016	94	16	24	18

Using Eviews7 was made the graphical representation of the four analysed variables (Fig. 4).

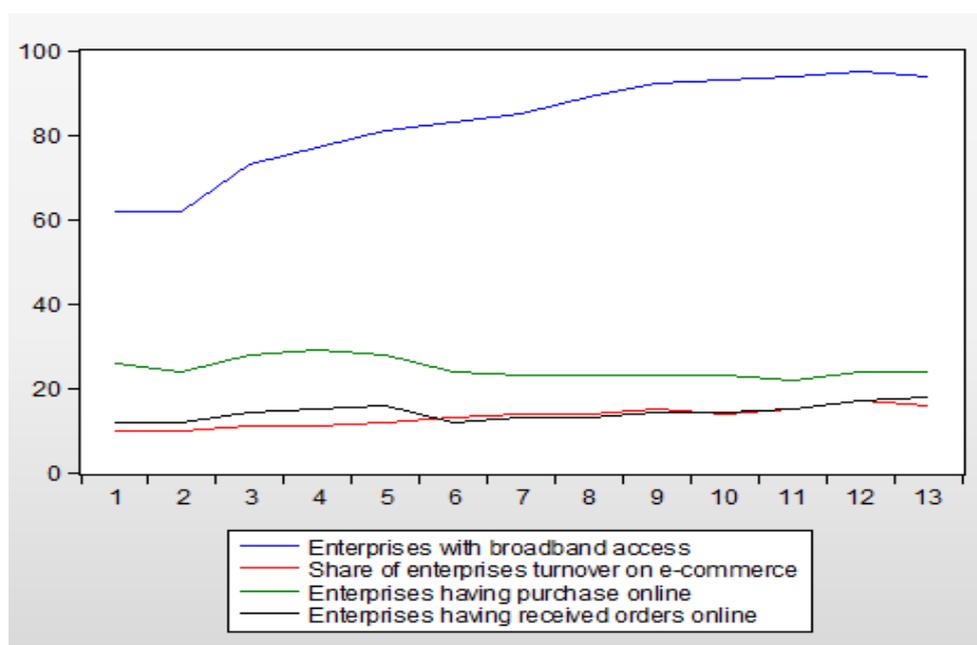


Figure 4. The graphical representation of analysed variables.

The graphical representation shows that there should be made analyse in order to develop a simulation model. It, ay be seen that there are for the dependent and independent variables four representations, but it is difficult to define a model based on the three independent variables.

The data sets may have similar statistical properties, but visually they are different, thus an OLS equation is indicated. To show that there is a direct and positive relationship between the analyzed variables is used the Linear Regression Model:

The regression function is using the following formula:

$$y = C_0 + C_1 \times X_1 + C_2 \times X_2 + C_3 \times X_3 + \varepsilon_t \quad (1)$$

where:

- C_0 is the intercept and C_1 - C_3 are the slope (or gradient) of the straight line [32].
- ε_t is having the form $\varepsilon_t = (\varepsilon_1 + \dots + \varepsilon_T)$ being a vector of the observed values and the estimated error terms respectively.
- y is the dependent variable and X_1 , X_2 and X_3 are the independent variables.

The calculations below shows the options of the least squares estimation method (NLS and ARMA), as well as the sample used in this analysis (Fig. 5).

Dependent Variable: ENT_ACCESS				
Method: Least Squares				
Date: 05/23/17 Time: 13:52				
Sample: 1 13				
Included observations: 13				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ENT_E_COMMERCE	5.605291	1.524386	3.677082	0.0051
ENT_E_PURCHASE	0.847338	1.230360	0.688691	0.5084
ENT_ORD_ONLINE	-0.554885	1.423672	-0.389757	0.7058
C	-4.111673	33.45946	-0.122885	0.9049
R-squared	0.886422	Mean dependent var	83.07692	
Adjusted R-squared	0.848562	S.D. dependent var	11.65091	
S.E. of regression	4.533948	Akaike info criterion	6.108723	
Sum squared resid	185.0102	Schwarz criterion	6.282554	
Log likelihood	-35.70670	Hannan-Quinn criter.	6.072993	
F-statistic	23.41352	Durbin-Watson stat	1.375124	
Prob(F-statistic)	0.000138			

Figure 5. Equation specification, estimation settings and options for doing univariate.

R-squared is the coefficient of determination with $0 \leq R^2 \leq 1$.

R is the coefficient of multiple correlations between all independent variables with the dependent variable.

In our case we obtained the following values for the regression function:

$$y = 5.605 * x_1 + 0.847 * x_2 - 0.554 * x_3 - 4.111 \quad (2)$$

R - squared is 88.64% and R is 94.14 thus results that x_1 - x_3 are very important factors in the evolution of y . Being a large value we may conclude that the model is a very good fit for estimating y through the chosen independent variables. Thus, to increase with a monetary unit, the x_1 will get a decrease of 5.605 monetary units of y and an increase with a monetary unit of x_2 will get an increase of 0.847 monetary units of y and an decrease with 0.554 monetary units. We note that the value of free term (-4.111) is negative but not so high, which allows us to conclude that the factors taken into account have an important impact on the evolution of y . Thus, the hypothesis **H1 - There is a positive and strong relationship between variables** is accepted, because it is indeed positive and strong having a value of 88.64%, being very close to 1.

Eviews7 helped to develop a summary of the descriptive statistics (Fig. 6) using data between 2004 and 2016. All the analyzed variables present a positive mean values. The mean for y is higher then the others. The range of variation between maximum and minimum is quite logical. We observe that the mean and median have very similar value, the ratio between them being approximately 1. The sum squared deviation represents the net change over the sample period, x_1 showing that it has increased very much. The y variable has the largest standard deviation among all the other analyzed variables.

Also, the standard deviation (Std. Dev.) of data series has small values for all the variables, therefore it can be considered that the series is relatively homogeneous. The results for y and x_1 are negatively skewed (showing a left-skewed distribution) while for x_2 and x_3 is a positive skewness. The value of kurtosis is between 1.84 and 2.31 being below the benchmark for a normal distribution of 3, which is positioned near normality.

	ENT_ACCESS	ENT_E_CO...	ENT_E_PU...	ENT_ORD_...
Mean	83.07692	13.23077	24.69231	14.23077
Median	85.00000	14.00000	24.00000	14.00000
Maximum	95.00000	17.00000	29.00000	18.00000
Minimum	62.00000	10.00000	22.00000	12.00000
Std. Dev.	11.65091	2.278664	2.287087	1.921538
Skewness	-0.755676	-0.031493	0.828842	0.539931
Kurtosis	2.314212	1.845130	2.220336	2.317925
Jarque-Bera	1.492016	0.724583	1.817722	0.883635
Probability	0.474256	0.696080	0.402983	0.642867
Sum	1080.000	172.0000	321.0000	185.0000
Sum Sq. Dev.	1628.923	62.30769	62.76923	44.30769
Observations	13	13	13	13

Figure 6. Descriptive statistics.

For all the values of kurtosis which are smaller than 3, are 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 0.72 and 1.81 (indicating that all the variables are approximately normally distributed). So, the hypothesis **H2- There is a normal distribution among the analysed variables**, is accepted.

Using Eviews it also can determine the relationship between the analyzed variables (Fig. 7).

Correlation				
	ENT_ACCESS	ENT_E_CO...	ENT_E_PU...	ENT_ORD_...
ENT_ACCESS	1.000000	0.937810	-0.530687	0.583540
ENT_E_CO...	0.937810	1.000000	-0.624851	0.595855
ENT_E_PU...	-0.530687	-0.624851	1.000000	0.131276
ENT_ORD_...	0.583540	0.595855	0.131276	1.000000

Figure 7. Correlation among variables.

The value obtained in the figure above shows us the strength of the relationship between the variables:

- If the value is zero, than the variables are not related to each other at all; in this case is no such a relation,
- If the value is between zero to one, it means that the relationship becomes stronger and stronger, and if it is closer to one, means that the variables are very strongly related to each other; in this case there is a very strong relation between y and x_1 (0.937), and two strong relations between x_1 and x_3 (0.595) and y and x_3 (0.583) and quite low but positive between x_2 and x_3 (0.131).
- If the value is between zero and minus one, it means that we have a low correlation and the two variables are a little bit related to each other, or not at all; between y and x_2 there is a a low correlation (-0.53) and between x_1 and x_2 (-0.62).

From these calculations results that the hypothesis **H3 - There is a corelation between the analyzed variables**, was partially accepted, because between six analyzed variables do exist direct and positive correlations (four of them) but also negative values (two of them).

For further analysis, Fig. 8 presents the residual histogram and the calculations for residuals.

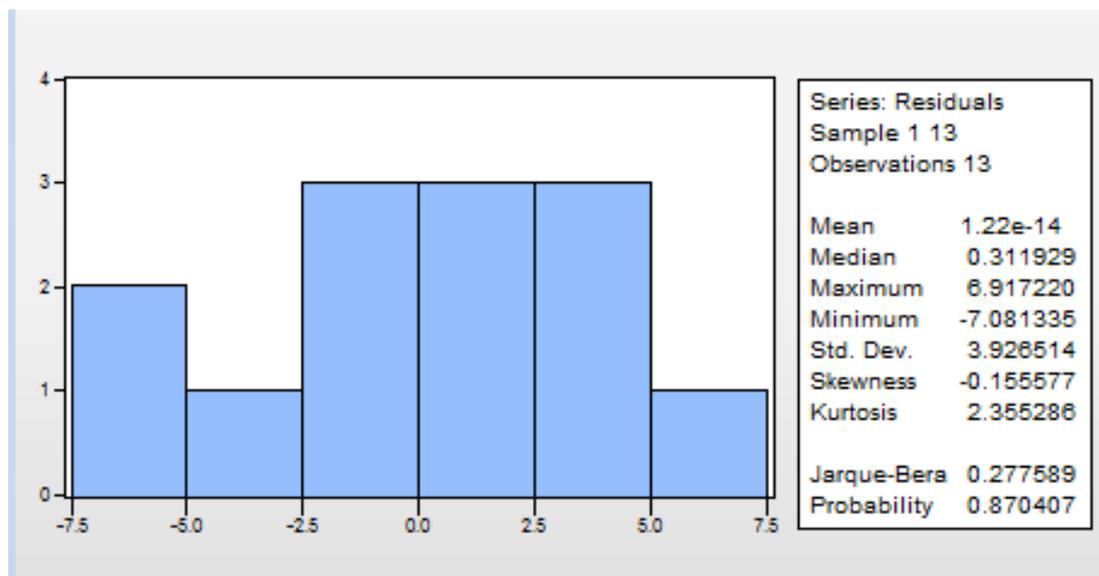


Figure 8. Histogram- normality test - Calculation made by the authors using Eviews7.

Thus, are presented some observations observed in this model:

- The residual histogram shows that there are some outliers that can be easily identified regarding the analysed data,
 - The Jarque-Berra test (JB) is based on the hypothesis that the normal distribution has the skewness, $S = 0$, and the kurtosis, $K = 3$. If the probability p of JB is enough low, then the normality hypothesis of residuals is rejected, and if the probability is high, the normality of residuals distribution is accepted. In our case (Fig.8) the value of JB test is 0.87.
 - It is observed that skewness = - 0.15; the negative skewness indicates that the residual is skewed to the left, which can be easily be identified on the histogram. A negative skew indicates that the tail on the left side of the probability density function is longer than the right side and the bulk of the values (including the median) lie to the right of the mean (CTI Reviews, 2016),
 - the kurtosis = 2.35, the probability of the test is = 0.87. We have a positive kurtosis (leptokurtic) which is associated with return distribution that are more peaked in the centre but that have fatter tails [31]. From these reasons we accept the hypothesis that the distribution of residuals follows almost a normal distribution.
- Thus, the hypothesis **H4 - There is a normal distribution for residuals** is accepted.

Case 2

In the second situation, data were collected at individual level, to observe the relation between the Internet and two independent variables regarding e-commerce at individual level, analysed in turn.

Before we do that, we take a look at European level on Internet and e-commerce (Fig. 9), on different years and on different characteristics.

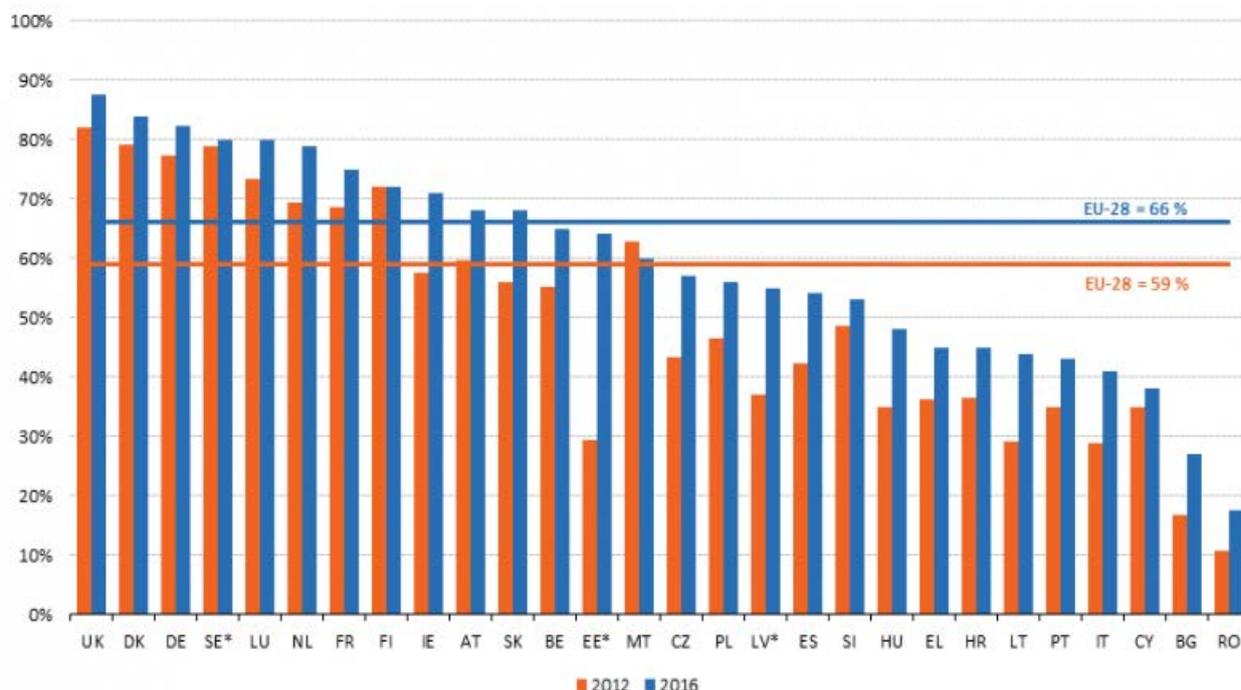


Figure 9. Internet users who bought or ordered goods or services for private use over the internet in the previous 12 months [30].

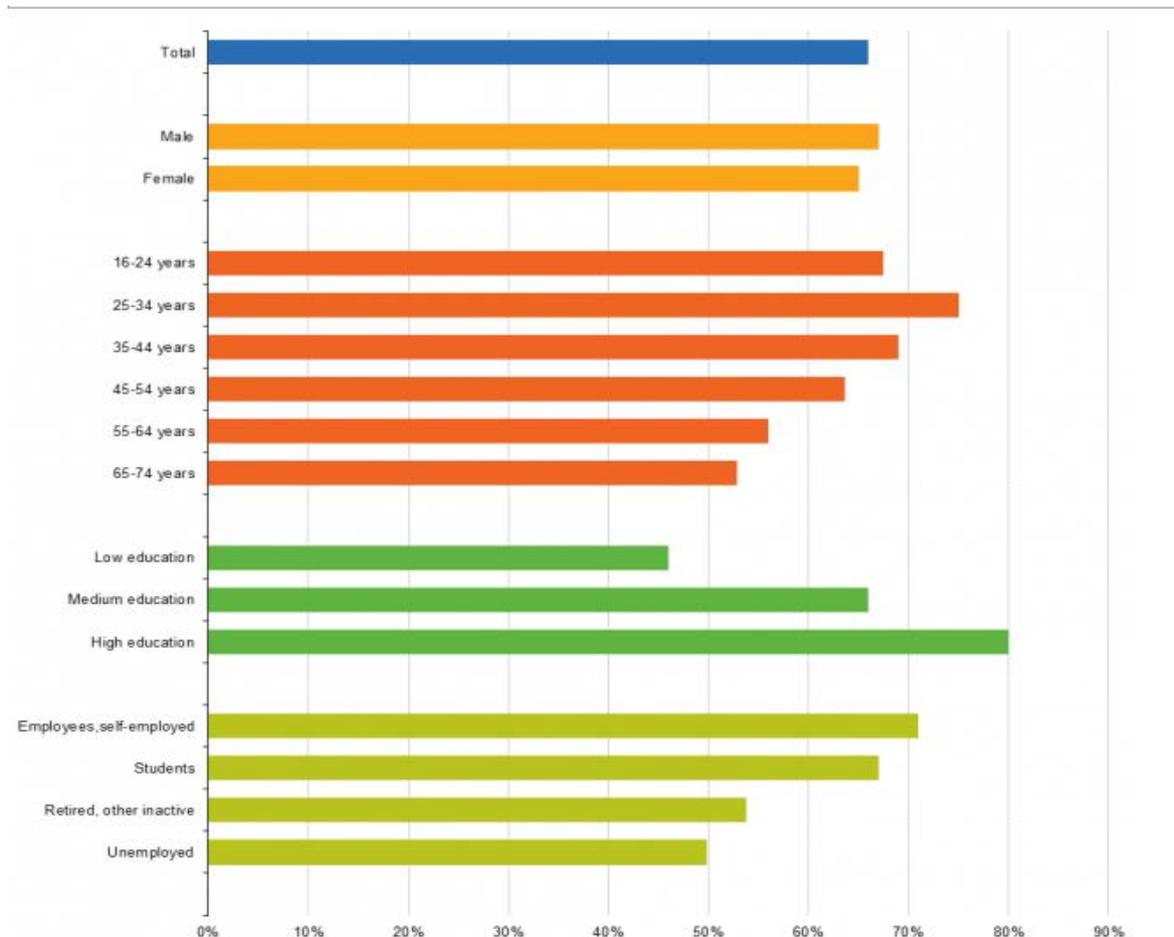


Figure 10. Online buyers depending on some characteristics [30].

As we may observe, individual e-commerce is very popular in the EU among its customers who want to buy at click distance. The proportion of individuals aged 16-74 having purchased online in the 12 months prior to the survey stood at 55 % in 2016 (Table 4). Consumers appreciate the convenience of being able to shop anytime anywhere, having access to a broader range of products, comparing prices and sharing their opinion on goods with other consumers. Gender, age, level of education and employment situation all affect e-commerce activity (Fig. 10).

As it is observed, the male bought online a little higher than female (67 % and 65 %, respectively). From the individuals aged 16 to 74 in the EU the one aged 25-54 had the highest share of online shoppers among internet users in 2016, followed by the ones aged 36-44 years and then by the ones aged in 16-24 years. The buyers with high education level we see that buy more than the others with lower level of studies. Employees and self-employed internet users are buying more over the internet (71 %) than unemployed internet users (50 %).

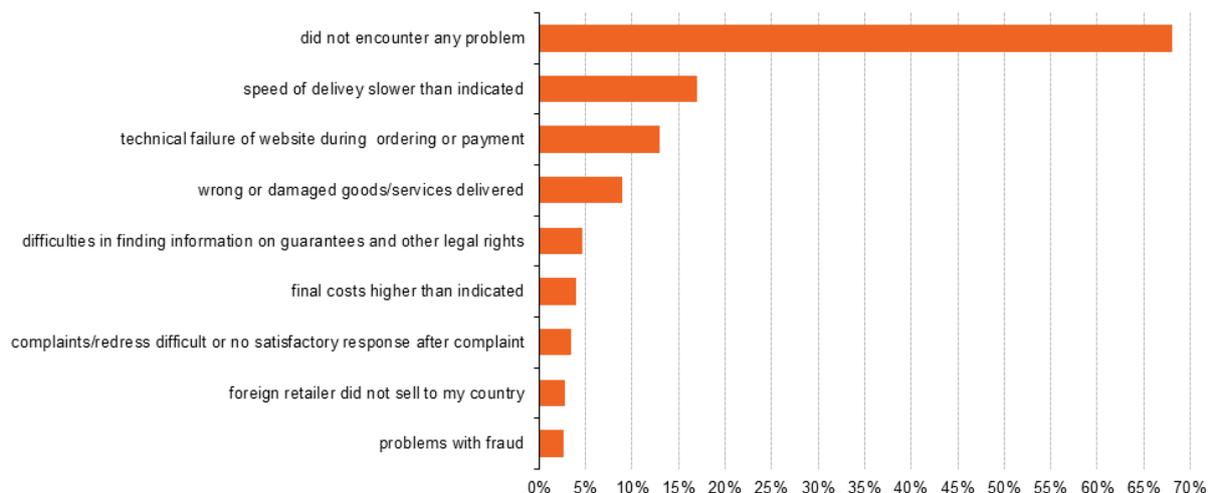


Figure 11. Problems encountered when buying over the internet, EU-28, 2016.

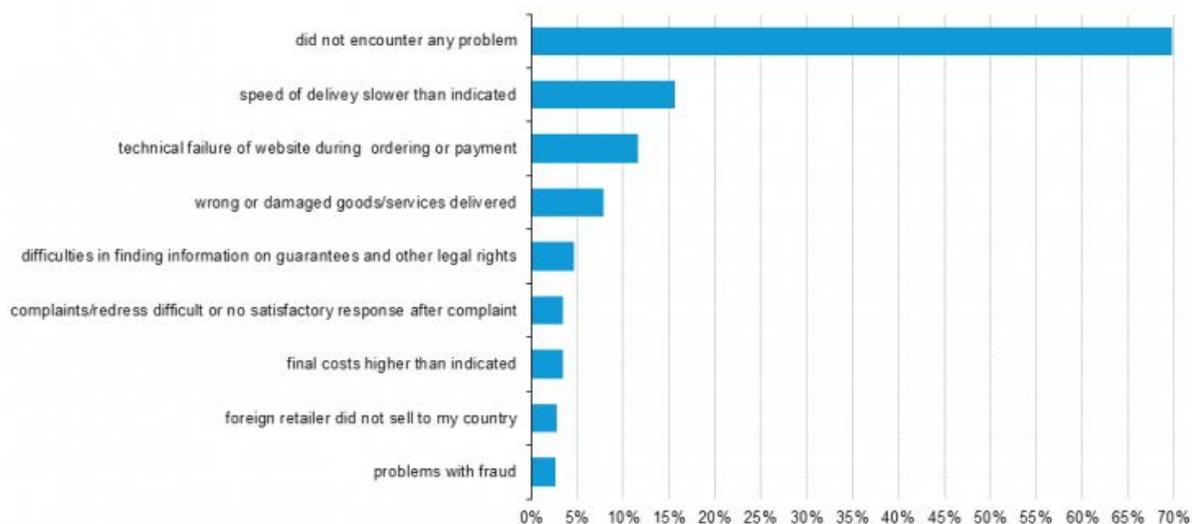


Figure 12. Problems encountered when buying over the Internet, EU-28, 2015.

Almost seven e-buyers out of ten reported that they did not encounter any problem when buying goods or services online (ec.europa.eu). The problems were related to (Figs. 11 and 12) slower delivery (17 % - 2016, 16% - 2015), technical failure of a website (13 % - 2016, 12%-2015), received wrong or damaged goods/services (9 %-2016, 7%-2015), had difficulties in finding information on guarantees and other legal rights (5 %-2016, 4%-2015), final costs higher than indicated (4 % - 2016, 3% - 2015), and so on. As a conclusion, it may be added that the problems encountered to buying online increased from 2015 to 2016.

Now, after the presentation of some indicators regarding the quality, the trend or the problems encountered at online shoppers at European level, on different years, we collected data from European level (EU-28) to observe the relation between the ability to use Internet and three independent variable, presented below (Table 4).

Table 4. Data collected about Internet and e-commerce at individual level (2004-2016) [15].

Year	Individuals level of Internet skills (e-skills) (y)	Individuals using the Internet for ordering goods and services (x1)	Individuals using the Internet for finding information about good or services (x2)	Individuals having ordered/bought goods or services for private use over the internet in the last three months (x3)
2004	31	24	39	16
2005	31	24	39	18
2006	30	26	41	20
2007	29	30	46	23
2008	29	32	50	24
2009	29	36	52	28
2010	31	40	56	31
2011	30	42	56	33
2012	30	44	61	35
2013	30	47	59	38
2014	31	50	64	41
2015	31	53	61	43
2016	32	55	66	45

Below we will present three cases in which are presented three summary outputs analysing the relation between individual internet skills (y) and:

- Individuals using the Internet for ordering goods and services (x1),
- Individuals using the Internet for finding information about good or services (x2),
- Individuals having ordered/bought goods or services for private use over the internet in the last three months (x3).

To determine the relation, its strength and other statistical indicators are using the regression function and this time is used Excel-Data Analysis (Table 5), which will follow the following formula:

Table 5. Summary output for the analysed three cases

The parametres	Case 1	Case 2	Case 3
Multiple R	0.96	0.98	0.95
R Square	0.93	0.97	0.91
Adjusted R Square	0.85	0.89	0.83
Standard Error	7.94	5.12	8.99
Observations	13	13	13
Intercept	0	0	0
Coefficients	0.73	0.55	0.91
St Error	0.05	0.02	0.07
t Stat	13.32	21.06	11.65
P-value	1.5	7.61	6.68
Lower 95%	0.61	0.49	0.74
Upper 95%	0.85	0.61	1.08

Source: calculations made by the authors using Excel-Data Analysis-AddIns.

Calculating the parameters of the linear model using least squares method, we obtained:

- Case 1- $y=0.73*x1$
- Case 2- $y=0.55*x2$
- Case 3- $y=0.91*x3$

Multiple R is the multiple coefficient of correlation between the dependent and independent variables. We may observe that there is a direct and very strong relation (Multiple R – between 0.95 and 0.98). Thus, it means that over 95% of the variance in the dependent variable Y is predicted or explained by the independent variables x1-x3. R^2 obtained values of 0.95, 0.96 and 0.98 being very close to 1, showing that the most of the

variance in the dependent variables originate in the variation of the regressors, as propagated through the model.

Adjusted R Square is a coefficient of determination corrected with the freedom degree having the same signification as R^2 . Standard Error shows the average of the values observed deviated from the theoretical values of the regression line (in this case with $\pm 0.02-0.07$, which is an insignificant modification). Lower 95%, Upper 95% are the upper and lower limits of the confidence interval for the parameters, following the ranges: b_0 for the first case will range between 0.61 and 0.85, for the second case between 0.49 and 0.61, and for the third case between 0.74 and 1.08.

From the formula founded by the simulation model results that x_1-x_3 are very important factors which influence the evolution of y . To increase with a monetary unit x_1 will get an increase of 0.73 monetary units of y , an increase with a monetary unit of x_2 will get an increase of 0.55 monetary units of y , and an increase with a monetary unit of x_3 will get an increase of 0.91 monetary units of y .

Based on the parameters obtained, we determine y for 2017 and 2018 and we obtain the following values (Table 6).

Table 6. Forecasted trend of y in 2017 and 2018

Year	X1	X2	X3	Y1	Y2	Y3	\bar{y}
2017 forecasted	57	68	48	41.61	37.4	43.68	40.89
2018 forecasted	59	71	51	43.07	39.05	46.41	42.84

From the formulas found by the simulation model, for the three cases, we determine y for 2017 and 2018, to observe the trend of y in the next period, increasing x_1 , x_2 , and x_3 with 2 or 3 percent, due to the observed data collected between the analysed periods.

It is obtained the following graphical representation for the actual and forecasted values for y (Fig. 13) between 2004 (the first year represented) and 2018 (the 15th value represented).

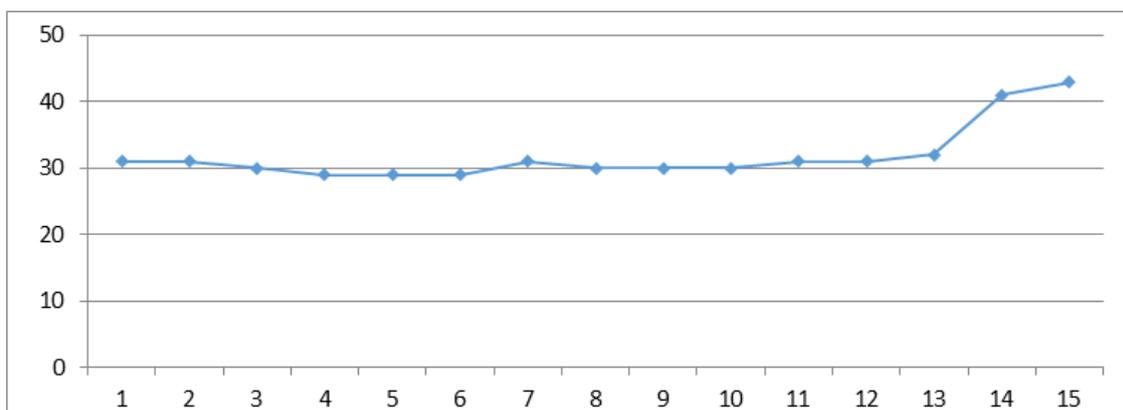


Figure 13. Graphical representation of y using line equation.

As a conclusion to this analysis is that increasing x_1 , x_2 and x_3 with 2 or 3 percent as the values showed by the trend, y will also follow a larger increasing, but the real situation is an increasing just with 3.22%, and not with 38.7% resulted from our calculations. E-skills, are not increasing the same for all world areas, for all the categories of jobs, age, sex, and gender, thus, the future trend for x_1 , x_2 and x_3 is an increased one (due to the offered advantages: reduced costs, distance, time, effort, and a maximum performance), but not with the same increasing for y .

4. CONCLUSIONS

Despite many disadvantages e-commerce is expanding rapidly. Internet is growing faster and offer new opportunities for organizations but also for the customers. Internet applicated in commerce has become a way of having business and a new way of life. Internet was accepted by the online organizations and customers to sale and to purchase online.

Now, the digital organizations, find in the e-commerce a new way to sale, to reach to a click away from the customers, and the digital customers, find in the e-commerce a new way to sale faster, cheaper, anywhere, and anytime.

From our analysis it is observing a positive and very strong relation between e-skills and e-commerce activities, at organization level as for individual level. Implementing a simulation model and Eviews and Excel programs, the specialists may forecast data, and see many scenarios which may bring many advantages, as: reduced costs, determine future risks, increase performance for both parts, just analysing and monitoring different situation at European level, necessary to make decisions in a proper manner and time.

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