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## **IMPROVING THE RELATIONSHIPS BETWEEN ORGANIZATIONS AND THEIR CUSTOMERS USING DIGITAL MULTICHANNEL COMMUNICATION AND MATHEMATICAL SIMULATION**

***Abstract.** We are living in the age of relationship marketing and relationships with customers are the central point of any business. And because a business cannot survive without its customers, in this article we will present their importance for organization and the new channels used to maintain a long-term relationship- effective digital multichannel, such as website, email, social media marketing channels or mobile apps, used to attract and satisfy the present and the potential customers' needs. We also will present the advantages and the new opportunities offered for customers but also for organization using new technologies. Using data from worldwide level we will develop a model using IT and mathematical programs such as EViews, MATLAB, regression function, and Markov chains to observe the relationship between the analyzed variables and the future trends of these multichannel used in online communication.*

***Keywords:** Markov chains, mathematical simulation, online business, social networking platforms, digital multichannel communication.*

**JEL classification: C15, D83, M15**

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### 1. Introduction

Consumers want always to obtain value, no matter what and from where they are buying. And no matter how good their needs are satisfied; the consumers expectations will accelerate. Global communication was helped by the technology advancement, such as Internet, Intranet, e-mail, fax and mobile phones Technology is a major factor who is influencing any field and is leading to globalization development, especially in communication. Communication is probably the most central process in organizations (Florea and Gilmeanu, 2016), thus this process has become important even for the small enterprises who also has global ambitions, facilitating them the collaboration with large enterprises or with the costumers from different zones (Lowell and Joyce, 2007), and relationships are created attracting and retaining customers and using two-ways conversations in order to create value (Gothelf and Seiden, 2017). The simulation and modeling techniques helped organizations to improve their future performance and predict future risks into the future (is not trying to replace the classical communication but to complete it), in a world of online business, online communication which is the backbone of all the organization' processes.

### 2. About the needs of customers and the new technologies

The needs of customers are continue to evolve, and to satisfy them the marketers must know them and understand them (Natarajan, 2017), must identify proactive methods to fulfill their needs and expectations, must monitored them, analyze the degree of satisfaction and to improve their product/service to offer them value, to credibility, trust and long term relationship. The challenge for any organization is satisfaction of customer's needs.

The customers ways of buying are changing; they are buying now faster, cheaper and better using Internet and new social media tools: website, email, social media marketing channels or mobile apps (Table 1). Any change is not accepted easily, comfortably, or readily (Albright, 2018), thus the penetration rate of Internet was 46.1% in 2016, but continue to raise (98% in Norway, Romania 58%, and Eritrea 1.1%) ([www.internetlivestats.com/internet-users-by-country/](http://www.internetlivestats.com/internet-users-by-country/)).

**Table 1. The use of Internet and social media websites in the world (2016-2017)(million)**

<b>Total world</b>	<b>Internet users (31 March 2017)</b>	<b>Facebook (01 Feb 2017)</b>	<b>Twitter (01 Feb 2016)</b>	<b>LinkedIn (01 Feb 2016)</b>	<b>Pinterest (01 Feb 2016)</b>	<b>Google plus (01 Feb 2016)</b>
7,519.029	3,696.240	1,800.000	310.000	255.000	250.000	120.000

Source: [www.internetworldstats.com](http://www.internetworldstats.com)

## Improving the Relationships between Organizations and their Customers Using Digital Multichannel Communication and Mathematical Simulation

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Internet has a unique characteristic: that of being available for anybody (Baran and Davis, 2012), of finding new data and information, of transmitting messages, of connecting to the markets, and of becoming more flexible and powerful every day (Thomas, 2007). Internet tends to grow in being a tool necessary for global communication. Internet, the new direct marketing tool, has led to sales growing through online orders. Due to its rapid global development, the Internet has become one of the most important media means that we can ever imagine.

As we may observe, the Internet has changed the way of shopping, offering fast information transfer and reduced costs, of interaction (Neustaldter et al., 2012) 24/7/365, development opportunities and the new social media tools offer a new opportunity to communicate, to relate, to collaborate, to make business, to entertain or to shop.

### 3. The websites

External communication with customers may be formal or informal; one of the tools used in this relationship are websites (Krizan et al, 2011) and in general are used by managers and organizations to find out the customers' needs or to collect information necessary to make decisions.

As we may see below, the customers' expectations are continuously evolving, and they are satisfied if the social media websites offer them convenience, personalization, speed, efficiency, empowerment, seamlessness, ease, authenticity and affirmation. Making a comparison, we may see the differences between these characteristics in the past and in the present (Table 2).

**Table 2. Customer expectation trends**

	<b>Then</b>	<b>Now</b>
Convenience	One-click	Dash buttons
Personalization	Perfect the customer journey	Optimize micro-moments
Speed	Overnight shipping	Same-day satisfaction
Efficiency	Hunt and peck	Voice recognition
Empowerment	Customer reviews	Response to comments
Seamlessness	Wearables and Apps	Nearables
Ease	PayPal	Apple Pay
Authenticity	Solid history	True transparency
Affirmation	Feeling of cool	Feeling of meaning

Source: [www.forbes.com](http://www.forbes.com)

The first website was developed in 1991 by the British physicist Tim Berners-Lee at CERN, in Switzerland. There are 1.2 billion websites on the world wide web in 2017. The website development continues from 1 website in 1991 to 1 billion in 2014. The trend of website evolution is seen below (Table 3).

**Table 3. The total number of websites in the world (2000-2015) (million)**

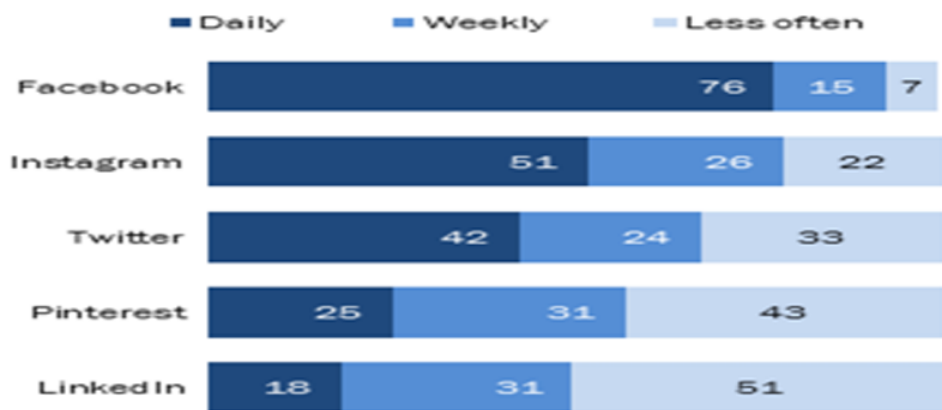
Year	2001	2005	2007	2009	2011	2013	2015	2017
Websites number	29.25	64.78	121.89	238.02	346.00	672.98	863.10	1002.00

Source: [www.internetlivestats.com/total-number-of-websites/](http://www.internetlivestats.com/total-number-of-websites/)

When it comes to a great website experience, internet users consider performance more important than fresh content, consistent experiences across mobile and desktop, and personalized content, finds Limelight Networks in a study entitled “The State of the User Experience”. For example, roughly 1 in 5 respondents aren’t willing to wait longer than 3 seconds for a website to load before getting frustrated and leaving (<http://trends.e-strategyblog.com/2016/>).

#### 4. Social networking platforms

A national survey of 1,520 adults conducted by the PewResearchCenter between March 7-April 4, 2016, finds that Facebook continues to be America’s most popular social networking platform and three-quarters (76% - of Facebook users report that they visit the site daily) and Twitter, Instagram, Pinterest and LinkedIn knew a significant increase over the past years (Figure 1).



**Figure 1. Use of social media tools**

Source: <http://trends.e-strategyblog.com/2016/12/03/frequency-social-media-use-network/27841>

### 5. Mobile apps

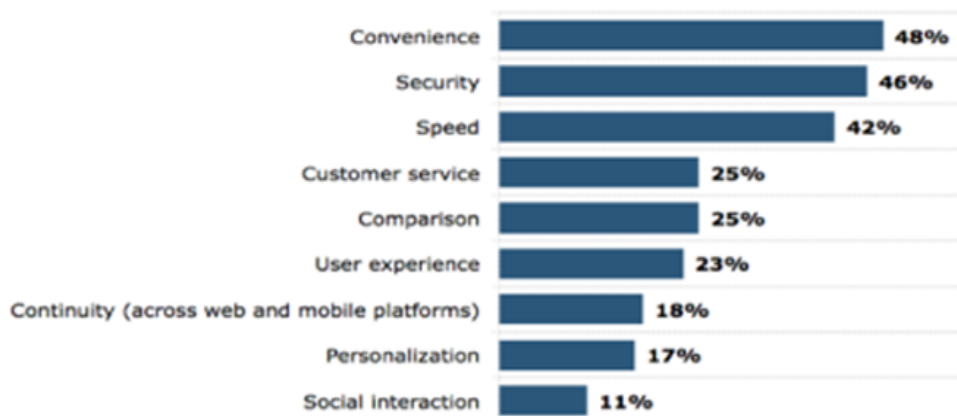
Now, the customers want to have many activities online, for their advantages, but, especially on the move. Thus, mobile tools have become important in their daily lives. A survey made in 2016 on 4,500 Internet users worldwide with over 18 years old showed the expectations for mobile experience (Figure 2).



**Figure 2. Future expectations for the mobile experience**

Source: <http://trends.e-strategyblog.com/2016/07/28/mobile-experience-expectations/27361>

We may observe that the internet users want more personalized apps (35%), a faster way to pay (33%), to deliver (27%), adaptation (25%), and so on. Another survey, also made in 2016 (among 4,500 mobile-owning adults across 11 countries), showed that convenience (48%), security (46%) and speed (42%) are the most important elements of a good mobile experience (Figure 3).



**Figure 3. The most important elements of a good mobile experience**

Source: <http://trends.e-strategyblog.com/2016/10/24/top-elements-good-mobile-experience/27676>

### **6.E-mail**

With the emergence of communication on Internet, a new form of communication has developed- e-mail communication that involves information exchange and depends on who uses it, the program used, the time of transmission / receipt and the answers given (Janoschka, 2004).

To efficiently transmit an e-mail, it is needed to know the address, to establish a subject, to mention the motive of writing it, to read it before transition, in order to avoid the errors and to use the introduction and the ending formulation (Jain et al., 2011).

E-mail is more and more used in daily communication of individuals and of organizations. The top ten used email positions are: 1. Apple iPhone: 33.0%, 2. Gmail: 15.8%, 3. Apple iPad: 11.6%, 4. Android: 10.3%, 5. Apple Mail: 6.6%, 6. Outlook: 6.7%, 7. Yahoo! Mail: 3.0%, 8. Outlook.com: 2.1%, 9. Windows Live Mail: 1.3%, 10. Thunderbird: 0.7% ([www.litmus.com](http://www.litmus.com)).

To see that email has become a very important part of our lives personal and professional, we offer some statistics:

- in January 2017 the number of emails sent daily was 269 billions emails;
- the number of e-mail users worldwide was in 2017 of 3.718 billion (<https://www.radicati.com/wp/wp-content/uploads/2017/01/Email-Statistics-Report-2017-2021-Executive-Summary.pdf>);
- Consumers have in 2017 an average of 1.7 accounts per user and in the next four years will continue to grow till 1.86 accounts per user (<https://www.radicati.com/wp/wp-content/uploads/2017/01/Email-Statistics-Report-2017-2021-Executive-Summary.pdf>);

## Improving the Relationships between Organizations and their Customers Using Digital Multichannel Communication and Mathematical Simulation

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- in 2016 the greatest number of emails were opened on mobile devices at 54%, Webmail ranked second at 30% and Desktop email opens dropped to 16%. ([www.litmus.com/2016](http://www.litmus.com/2016));
- people check e-mail while watching TV or while watching a movie (69 percent), in bed (57 percent), and on vacation (79percent) ([www.adobe.com/2016](http://www.adobe.com/2016));
- a percent of 67,2% of consumers use a smartphone to check their e-mail, 42,3% use a tablet while 93,3% uses desktop environment ([www.bluehornet.com/.../2015-Consumer-Views-of-Email-Marketing-2015](http://www.bluehornet.com/.../2015-Consumer-Views-of-Email-Marketing-2015)).

Also, sending and receiving so much emails, and to avoid the risk of overloading, organizations implemented effective programs in order to budget the employees' time (consisting in sorting or redirecting emails or reducing the time to work with them- creating a day of „e-mail free”) (Hynes andVeltsos, 2018).

### **7.Research methodology**

Our research has two objectives:

- 1.to observe the relationships between Internet users and the users of new media channels using IT simulation and mathematical modeling- EViews program and regression function,
- 2.to improve the website experience using simulation- MATLAB and Markov chains,
3. to observe the trend of different social media tools also applying a simulation method based on Markov chains.

#### **7.1.Analysing the relationships between analysed variables using data from world level between 2009-2017**

In this research we used data regarding the use of social media worldwide (Table 4) influenced by the use of the Internet. Due to the fact that Internet increased its users numbers, and the interest in using social media platforms has also increased, we consider as important the relationship between these variables. We want to determine if there is a relationship between these variables and how strong it is.

**Table 4. Data regarding the analysed variables**

Year	World Internet users (million) ( <a href="http://www.internetlivestats.com">www.internetlivestats.com</a> )	Nb of active Facebook users worldwide (million) ( <a href="http://www.statista.com">www.statista.com</a> , <a href="http://www.finance.yahoo.com">www.finance.yahoo.com</a> )	Nb of monthly active Twitter users worldwide first quarter (million) ( <a href="http://www.statista.com">www.statista.com</a> )	Nb of email users worldwide (million) ( <a href="http://www.radicati.com">www.radicati.com</a> )	Nb. of websites worldwide (million) ( <a href="http://www.internetlivestats.com">www.internetlivestats.com</a> )
2009	1,766	350	20	2,192	238
2010	2,023	608	30	2,200	206
2011	2,231	845	68	2,350	346
2012	2,494	1,010	138	2,370	697
2013	2,728	1,228	204	2,400	672
2014	2,956	1,393	255	2,500	968
2015	3,185	1,591	302	2,586	863
2016	3,424	1,860	310	2,672	966
2017	3,655	1,940	328	2,760	1,206

Source: [www.internetlivestats.com](http://www.internetlivestats.com), [www.statista.com](http://www.statista.com), [www.radicati.com](http://www.radicati.com), <https://finance.yahoo.com/>

To see such a relationship, we can use the function of multiple regression which is a method of studying the evolution of a dynamic system starting from the successive observations of some characteristics of the system (Florea and Mihai, 2015).

Using regression function and EViews7 program we analyse if there is a relationship between the analysed variables and its strength on 9 years.

We consider as dependent variable: World Internet users and as independent variables: Nb of active Facebook users, Nb of monthly active Twitter users, Nb of email users and Nb. of websites.

Using Least squares method (OLS) (Table 5), we may observe that R-squared is 99.08%, being a very strong and positive relationship between the analyzed variables.



Improving the Relationships between Organizations and their Customers Using Digital Multichannel Communication and Mathematical Simulation

**Table 5. Least squares method**

Dependent Variable: WORLD_INTERNET_USERS__MI				
Method: Least Squares				
Included observations: 9				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
NB_OF_MONTHLY_ACTIVE_TWI	0.003154	0.001672	1.886726	0.1322
NB_OF_EMAIL_USERS_WORLDW	1.405752	0.845314	1.662995	0.1716
NB_OF_ACTIVE_FACEBOOK_US	3.62E-05	0.000193	0.187906	0.8601
NB_OF_WEBSITES_WORLDWID	-8.32E-05	0.000127	-0.653973	0.5488
C	-1.264469	1.794587	-0.704602	0.5199
R-squared	0.990832	Mean dependent var		2.718000
Adjusted R-squared	0.981663	S.D. dependent var		0.644972
S.E. of regression	0.087338	Akaike info criterion		-1.737886
Sum squared resid	0.030512	Schwarz criterion		-1.628316
Log likelihood	12.82048	Hannan-Quinn criter.		-1.974336
F-statistic	108.0705	Durbin-Watson stat		2.521807
Prob(F-statistic)	0.000251			

Source: Calculation made by the authors using EViews7

Using EViews is obtained the following regression function:

$$Y = 0.003*x_1 + 1.4*x_2 + 3.6*x_3 - 8.3*x_4 - 1.26(1)$$

From the formula founded by EViews7 results that the chosen independent variables are very important factors in the evolution of dependent variable.

**Table 6. Correlation between variables**

Variables	WORLD_INTE RNET_USERS _MI	NB_OF_MONT HLY_ACTIVE_ TWI	NB_OF_EMA IL_USERS_ WORLDW	NB_OF_AC TIVE_FACE BOOK_US	NB_OF_WEBS ITES_WORLD WID
WORLD_INTERNET_U SERS_MI	1				
NB_OF_MONTHLY_A CTIVE_TWI	0.98	1			
NB_OF_EMAIL_USER S_WORLDW	0.98	0.95	1		
NB_OF_ACTIVE_FACE BOOK_US	-0.69	-0.77	-0.62	1	
NB_OF_WEBSITES_W ORLDWID	0.33	0.45	0.27	-0.52	1

Source: Calculation made by the authors using EViews7

The values obtained in the table above (Table 6) shows the strength of the relationship between the variables:

- If the value is 0- the two variables are not related to each other at all. In this category there is no correlation.
- If the value is between (0 and 1)- the relationship becomes stronger and stronger, and if it is closer to one, means that the two variables are very strongly related to each other. In this category there are three correlations, as follows: the strongest correlation is between y and x1 and x2 (0.98) being very close to 1, between x1 and x2 (0.95). Wicker relationships are between x1 and x4 (0.45), y and x4 (0.33) and the wickest but positive is between x2 and x4 (0.27).
- If the value is between (0 and -1)- is a low correlation and the two variables are a little bit related to each other, or not at all. Here there are correlations, as follows: x3 and x4 (-0.52), x2 and x3 (-0.62), y and x3 (-0.69) and lower value is obtained for x1 and x3 (-0.77).

As a final conclusion, we may add that Y (Internet users) is influencing the number of Twitter users and the email users in the world. Facebook, as we may see is not influenced only by the ability to use Internet, but from other different reasons, too: age, sex, gender (female use more then male), comments received, life events, health, marrital status, job, geographical area, and so on.

### 7.2.Improving a website experience

We used data from a survey made in 2015 and 2016 (Table 7) and using simulation- Markov chains we want to see the trends for the analysed characteristics for the next years.

**Table 7. Internet users expectations from a website experience (%)**

Expectations	Year	4 (most important)	3	2	1 (least important)	The score
Performance	2015	52	26	9	13	3.17
	2016	50.2	27.1	14.2	8.5	3.19
Fresh and updated content	2015	39	29	19	13	2.94
	2016	43.4	28.4	19.5	8.7	3.06
Consistent experience	2015	20	27	35	18	2.49
	2016	23.5	27.7	32.3	16.5	2.582
Personalized content	2015	12	18	26	44	1.98
	2016	14.6	20.0	21.3	44.1	2.051

Source: [www.trends.e-strategyblog.com](http://www.trends.e-strategyblog.com)

## Improving the Relationships between Organizations and their Customers Using Digital Multichannel Communication and Mathematical Simulation

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The scores obtained for the characteristics for 2016 are (3.19; 3.06; 2.582; 2.051), and their summing up is 10.883. Thus, the vector line is becoming:(29.3%; 28.1% 23.7%; 18.9%).

The matrix formed by the values from 2015 will be multiplied with the line vector from 2016, according to Markov chains method:

$$M = \begin{pmatrix} 52 & 26 & 9 & 13 \\ 39 & 29 & 19 & 13 \\ 20 & 27 & 35 & 18 \\ 12 & 18 & 26 & 44 \end{pmatrix} \times (29.3 \quad 28.1 \quad 23.7 \quad 18.9)$$

in order to observe the trend of the four analyzed variables of a website or the following years.

Using MATLAB program, we obtained the following results (Table 8).

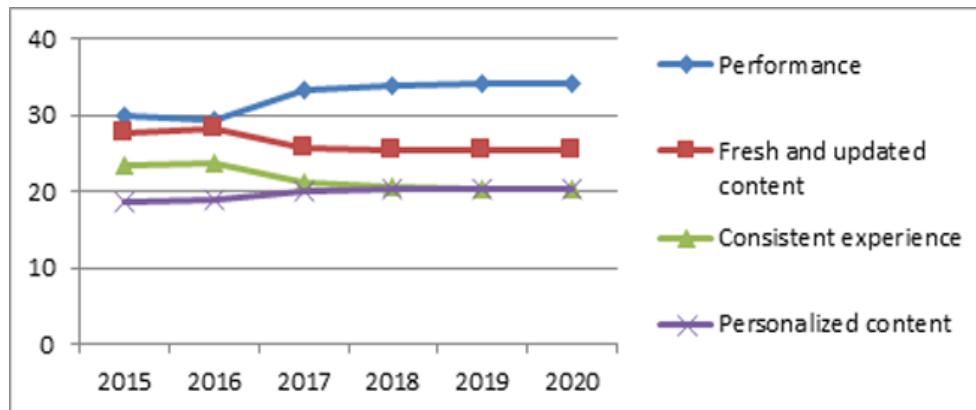
For 2015, the values are (3.17; 2.94; 2.49; 1.98); summing these values we obtain 10.58; dividing each value to this sum we obtain the following results necessary for the table.

**Table 8. The trend for the four analyzed variables of a website between 2015 and 2020**

Characteristics/year	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020
Performance	30.0	29.3	33.2	33.8	34.1	34.1
Fresh and updated content	27.8	28.1	25.6	25.4	25.3	25.4
Consistent experience	23.5	23.7	21.2	20.5	20.3	20.2
Personalized content	18.7	18.9	20	20.3	20.3	20.3

*Source: Authors calculations using MATLAB.*

These results are graphically represented to observe the trend of variables for the following period.



**Figure 4. The trend of the four analyzed variables of a website (2015-2020).**

We may observe that till 2020 (Figure 4) the performance and the personalization are the most wanted variables for an efficient website, while fresh and updated content and consistent experience are obtaining lower values due to the fact that from the habit of working with the computer, browsing the internet, using the website to order online, the current consumer is no longer so impressed by these variables as the beginning of the e-commerce period. Thus, the new e-consumer is focusing on obtaining performance in a continuous changing and challenging environment and on personalized content, because the business is now made on-to-one, customized, not in mass as before.

### 7.3. Analyzing the trend of social media tools frequency use

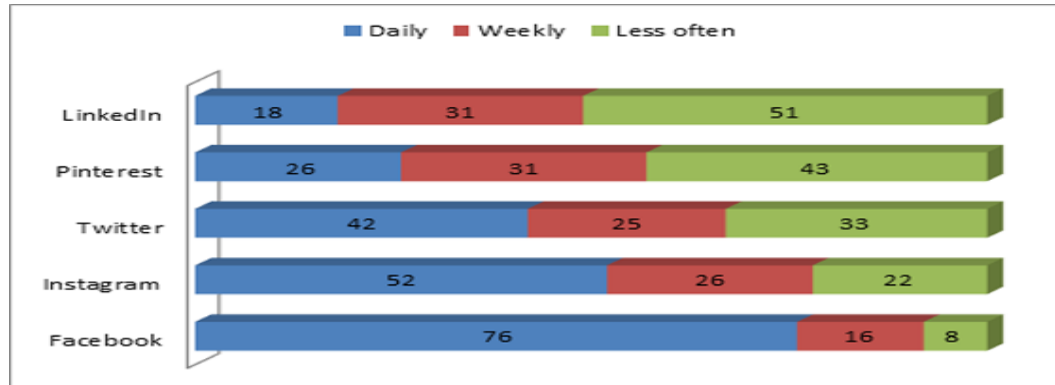
According to statistics, Facebook is the most important social platform among B2C marketers, at great difference followed by Twitter (10%), LinkedIn (9%) and others (Table 9).

**Table 9. Most important social channels (2015)**

Facebook	Twitter	LinkedIn	YouTube	Google+	Pinterest	Instagram	Forums & Social review sites
65%	10%	9%	4%	4%	4%	3%	1%

Source: [www.marketingcharts.com](http://www.marketingcharts.com)

Improving the Relationships between Organizations and their Customers Using Digital Multichannel Communication and Mathematical Simulation



**Figure 5. The use of social media platforms**

Source: adaptation after [www.trends.e-strategyblog.com/2016/12/03](http://www.trends.e-strategyblog.com/2016/12/03) and the authors calculation

Extracting data from the graphic above just for three social media tools are obtained the following data for each analyzed variable (Table 10).

**Table 10. Frequency use of social media tools**

	Daily	Weakly	Less often
Facebook	76	16	8
Instagram	52	26	22
Twitter	42	25	33

We made their summing up, then we transformed them into a line vector (Table 11).

**Table 11. Data for three most important multichannel communication**

Facebook	Instagram	Twitter	Sum
65	3	10	78

Making their wight from the total summing up, it is obtained:

Facebook-  $65/78=0.83$

Instagram-  $3/78=0.04$

Twitter-  $10/78=0.13$

Thus, the vector line is:

$(0.83 \ 0.04 \ 0.13)$

The values for frequency use we multiply them with the line vector, according to Markov chains theory. Thus, we obtain the trend for the next period for the three analyzed social tools.

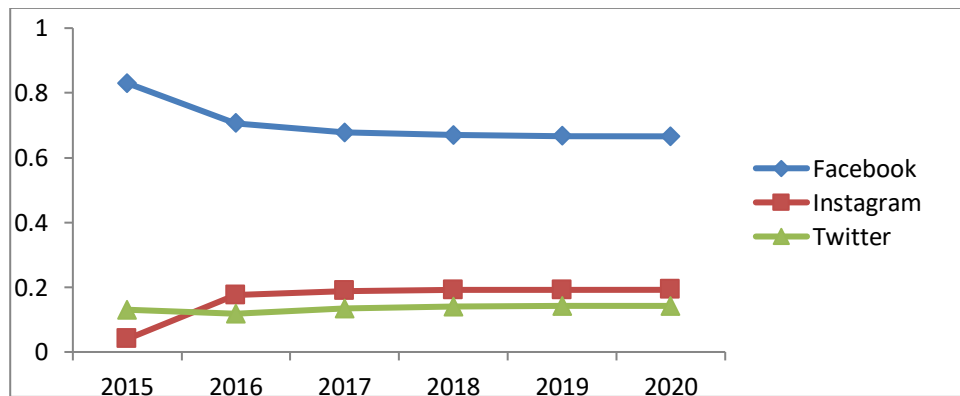
$$\begin{pmatrix} 0.76 & 0.16 & 0.08 \\ 0.52 & 0.26 & 0.22 \\ 0.42 & 0.25 & 0.33 \end{pmatrix} \times (0.83 \quad 0.04 \quad 0.13)$$

We obtain the following values for FIT, using Markov chains and MATLAB (Table 12).

**Table 12. Trend of FIT using Markov chains**

Trend of SMT/year	2015	2016	2017	2018	2019	2020
Facebook	0,83	0,7062	0,677678	0,66923	0,666627	0,665821
Instagram	0,04	0,1757	0,188199	0,190891	0,191678	0,19192
Twitter	0,13	0,1181	0,134123	0,139879	0,141694	0,142259

The graphical representation is made below, showing a different trend than the current values (Figure 6).



**Figure 6. The graphical representation of future trend of FIT.**

It may be observed for a simulated future, that the interest for Facebook (from 83% in 2015 to 66.58% in 2020 provisioned) is decreasing due to gaining interest in using Instagram (from 4% in 2015 to 19.19% in 2020 simulated), but still remaining the most used communication e-tool and for Twitter is registered just a small but positive increasing (from 13% in 2015 to 14.22% in 2020).

### **8. Conclusions**

Consumers needs are more and more challenging and in change performance organizations came with a new method of communication, more rapid, more efficient, and cheaper. If they do not receive added value, they will rapidly leave the social media provider. More and more consumer uses online activities: communication, finding a job, selling or buying online, banking, booking, and others; thus organizations are experiencing with new and expectations. To retain, attract and grow the number of e-customers, they must offer convenience, reduced costs, various products and services, good prices, good quality, good websites. Their offer must be at a click distance and think quicker then the competition. Thus, if the products are hard to see, or slowly, they will lose the customers. For that they must implement new programs using IT and communication systems such as social media, mobile activities, and ofcourse new simulation and modeling methods to see from time the trend of their future activities and the future risks.

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