ORIGINAL PAPER

IMPROVING LONG-TERM RELATIONSHIPS BETWEEN ORGANIZATIONS AND CUSTOMERS USING MARKETING DATABASES AND SIMULATION MODELS

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Abstract. *This article presents the benefits of marketing databases (MDB)and highlights its importance in analyzing and tracking the customers' direct responses using economic and mathematical models. Due to the continuously changing behavior of customers and the uncertain environment, our article will show that to satisfy customers and to obtain performance, the creation of MDB represents an essential step in efficiently communicating and improve marketing efficiency. This study also aims to investigate (using E-views and regression function) if, in this digital economy, there is a relationship between creating MDB and the ability of customers to work with the Internet, to order goods online and also if the organization can implement a marketing software. Finally, our research shows the importance of measuring the value of customers by implementing adequate models of analyzing the loyalty of the customers.*

Keywords: *econometrics, customers value indicators, marketing databases, mathematical models.*

1. INTRODUCTION

To justify the need for the economic and mathematical models used, we present, firstly, an analysis of the literature review that focuses on the study of the relations between organizations and customers and secondly research of marketing databases determined according to the existing different customers' preferences and value of the purchase. To better understand the importance of customers for organizations, this article presents two kinds of analysis: the first one is consisting of implementing simulation to strengthen the relationships with customers using regression function and marketing databases; the second one is explaining some models and calculated some indicators to determine the customer's value to improve these relationships.

To satisfy the customers' needs, organizations must achieve their seven "rights" [1]: right product, right quantity, right quality, right time, the right price, and right service. To increase productivity, control of operations, and understand customers' needs, organizations use historical and unusually detailed data obtained from numerous computing and point-of-contact devices. The databases can now provide information about consumers' behaviors,

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which merged, enriched, and transformed into meaningful information. Computers have become a must in any competitive business [1]. As the first step in the evolution of today's Internet, in the field of marketing, we consider database marketing very important [2].

In a world of powerful computers, personal software applications, and easy-to-use analytical end-user software tools, managers and implicitly organizations have the power to segment and directly address marketing opportunities through well-managed processes and marketing strategies [3]. Every touch-point made between organization and customer is essential and must be carefully monitored to find out the future significance of this relationship and human connection [4]. The ability to attract, retain, and recover customers more and more play an essential role [5]. The customer has been the central point of any business for decades [6], and to better understand customers' behavior, the company must do thorough marketing research [7]. A customer is any user of a business process's output [8].

The current society is in its fifth era of marketing, that of relationships and power, so our study refers to it. The environment is rapidly changing due to [5, 9]: the evolving end-customers' expectations which made companies more responsive; the shortened product life cycles; the saturated markets; the high level of competition; greater responsiveness and quality consciousness from organizations; market consolidation as a result of strategic alliances who focuses on the best customers; globalization, and ICT in e-commerce brought better visibility of demand/supply, logistics and communication across the globe as easy as buying locally, or the erosion of customer loyalty who seek lower prices and better quality. Long term profitable relationships with customers are the goal of CRM [10, 11]. Companies designed CRM systems to help companies sell more products or services to customers [12, 13]. Any organization relies on its customers [14]. The customers are the reason that relationship with customers is becoming the most crucial part of a business because it cannot survive without its customers [15]. Florea and Tanasescu [16] says that communication with customers supposes the development of strong relationships based on attracting, retaining, and developing the skills of the talented employees with one crucial objective: to offer a product/a service better, cheaper and quicker. Keeping customers is an essential component of any successful business [17]. Choosing a way of communication or another is very important for the organization in the relationship with the customer [18]. Orientation on customers is a way to keep a strong relationship with them, modeled after its intensity [19].

Methods of data-based customer management are used to handle these challenges [5], and marketing database technologies were used by marketers to reach customers in ways they had only dreamed of before [2]. Therefore, building a long-term relationship between organizations and customers, loyalty through relationship management is not anymore, a choice, but a crucial element for obtaining a competitive advantage. To create a unique customer experience, an organization must understand its customers by creating a consolidated view of the customer relationship [20]. The creation of knowledge bases provides profitable opportunities for business [3]. To manage quickly and effectively its customers, the organization must implement various database management systems through which the person uses it to interact with different databases [21].

The creation of databases has become a process of discovering information, data, ideas, and a tool for understanding consumer needs, preferences, behavior, helping the marketing department to find new customers, and keep old customers [9]. This is an important process and often leads to three CRM strategies: customer privacy (involves the delivery of services to customers to knew them better and to offer them products/services using personalized communication); operational efficiency (supposes reducing costs and efficient use of non-marketing resources); marketing efficiency (supposes using data referring to consumers) [22].

Setting-up a database consists in deciding how, when, and where to use the data and implement the easiest system to achieve the objective, determining database benefits from relationships, and targeting, testing, measuring, and improving performance [23]. Various authors mention some essential characteristics of a marketing database: targeting (properly reach customers to obtain a prompt response), direct features (communication goes directly to the client), and marketing features (helps to achieve customer satisfaction and profit for the organization) [24]. To achieve success, any organization must rely on the relationship with customers using dialogue as a communication form. This dialogue should be customer-driven, relevant, intelligent, continual, and adaptive according to the different needs of customers. This dialogue must follow few stages (initiation - making contact with customers, development - building relationships and termination - end of the connections) to be effective and to make long term and profitable relationships with customers [20].

In many specialists' opinions, using marketing databases brings the following benefits: enable marketers to determine the critical factors which influence customer satisfaction [25]; help to know the purchase behavior of current and potential customers [22]; increase marketing productivity, by quantifying effectiveness and improve it; effectively manage customers, by attracting and acquiring new ones and maintaining the present ones; can be used in various sectors such as telecommunications, banking, healthcare, insurance, retail, and financial sectors [9]; offer the opportunity to get more information about the wishes, the quality, aesthetic, price and the utility of a product [21]; can lead to control of information redundancy, facilitate consistency of information, and improve information integrity [21]; can improve information security, increase productivity, and reduce conflicts [21]; can create personalized services, make an analysis of problems encountered, and also can lead to customer satisfaction [22]; can create a sustainable advantage in the market, offer the opportunity to collect direct answers, and offer the opportunity to monitor feedback [24]; can provide a chance to measure and quantify answers, to evaluate and analyze them.

An organization can get information about a client, providing answers to the following questions [26]: Who? - determines the identity of the buyer, What? - determines what the customer has bought, How much? - determines the amount spent by the customer, How- determines the sales channel used by the client, and Why?- determines the reason for buying a product. The answers to these questions are stored in computers until the specialists decide if they are relevant, and then will be archived. In this way, patterns can be developed on the buying process of the customers, establishing what they buy, why, where, how much is spending, and how often [26].

2. METHODOLOGY

Measuring, managing, and maximizing profits, quality, utility, and health issues for customers, the organization involves a large amount of information and large consumption of resources to attract, satisfy and retain these customers [27]. To solve their problems, the specialists may use simulation and modeling techniques, especially when the entire system does not allow experiments [28], such as regression function and economical-mathematical models, such as CLV, MAD-FU or PCV.

A. Regression function

Simulation [29], and regression, as simulation method is very used and straightforward to predict human performance for decision-making in organizations [30].

Regression analysis indicates trends and future values and can be used for several purposes, including the following [31]: data description, parameter estimation, prediction and estimation, and control.

The simplest form of the equation with one dependent and one independent variable is defined by the formula presented below:

$$y = c + b \cdot x,$$

where: y is estimated dependent score; c is a constant; b is regression coefficients; x is the independent variable. The dependent variable situated on the left side of the equation it's affected by the independent variables, which are on the right [32].

The regression function is a method of studying the evolution of a dynamic system, starting from the successive observations of some characteristics of the system. Regression function used to predict the value of a dependent or "response variable", y, is considered to be controlled by either a single predictor or "explanatory variable" (x). The fitted model,

$$y = f(x),$$

is a linear function [33].

Let y denote the response (dependent) variable, and let X=X1, X2, ..., Xp denote a list or vector of predictor variables [34].

This dependency modeled through a linear equation, it's as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + \cdots + b_nX_n, \quad (1)$$

known as the multiple regression function.

The coefficients are determined by using the least-squares method (Ordinary Least Square) which is a method for estimating the unknown parameters in a linear regression model, to minimize the sum of the squares of the differences between the observed responses, thus, it is noted with:

$$\varepsilon^2 = (Y - b_0 - b_1X_1 - b_2X_2 - \cdots - b_nX_n)^2. \quad (2)$$

the square of approximation error of the system evolution. Variables that enter a regression equation are often measured with error. Still, the ordinary least squares estimates of the regression coefficients do not take this into account [35]. The difference between the observed value of y and the straight line is the error, which may be made up of the effects of other variables on delivery time, measurement errors, and so forth [31].

The slope can be interpreted as the change in the mean of y for a unit change in x. The variability of y, at a particular value of x, is determined by the variance of the error component (σ^2). This model implies that there is a distribution of "y" values at each "x" and the variance of this distribution is the same at each x [33].

The independent variables: $X_1, X_2, \ldots X_n$, and Y are considered vectorial variables and are representing the measures made on the system at a particular time, in m different moments [36].

$$X_1 = \begin{pmatrix} x_{11} \\ x_{21} \\ . \\ . \\ . \\ x_{m1} \end{pmatrix}, X_2 = \begin{pmatrix} x_{12} \\ x_{22} \\ . \\ . \\ . \\ x_{m2} \end{pmatrix}, \ldots, X_n = \begin{pmatrix} x_{1n} \\ x_{2n} \\ . \\ . \\ . \\ x_{mn} \end{pmatrix}, Y = \begin{pmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_m \end{pmatrix}. \quad (3)$$

The least-square method resides in determining the coefficients of the regression function: $b_0, b_1, \ldots, b_n$ so that the square of approximation error:

$$\varepsilon^2 = (Y - b_0 - b_1X_1 - b_2X_2 - \cdots - b_nX_n)^2. \quad (4)$$

The above function must be minimized.

Solving this minimum issue supposes the next notations:

$$B = (b_0 b_1 \ldots b_n)^t \in M_{(n+1)\times 1} \quad (5)$$

which is representing the matrix of linear coefficients of the regression function, the matrix must be determined in the minimum point, with:

$$X = \begin{pmatrix} 1 & x_{11} & x_{1n} \\ \ldots & \ldots & \ldots \\ 1 & x_{m1} & x_{mn} \end{pmatrix} \in M_{m\times(n+1)} \quad (6)$$

and is considered as the observation matrix.

With these notations, the problem is transforming in the determination of the next minimum:

$$\min_B (Y - XB)^2 = \min_B (Y^2 - 2YBX + B^2X^2) \quad (7)$$

reached for:

$$B_{min} = \frac{Y}{X^t} = \frac{X^tY}{X^tX} = (X^tX)^{-1}X^tY. \quad (8)$$

Based on the measurement made on the system is following the determination of the coefficients of the regression function and so its evolution for the next period can be anticipated.

$$\hat{Y} = XB_{min}, \hat{Y} = X[(X^tX)^{-1}X^tY]. \quad (9)$$

A particular case is when the Y variable depends on a single variable X_1, and in this case, the matrix may become:

$$Y = \begin{pmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_m \end{pmatrix}, X_1 = \begin{pmatrix} x_1 \\ \ldots \\ x_m \end{pmatrix} X = \begin{pmatrix} 1 & x_1 \\ \ldots & \ldots \\ 1 & x_m \end{pmatrix}, B = \begin{pmatrix} b \\ a \end{pmatrix}, Y = XB = b + aX, \quad (10)$$

and is known in econometrics as regression.

Its coefficients are calculated, as well:

$B = (X^tX)^{-1}X^tY$customyzed for a single independent variable.

$$X^tX = \begin{pmatrix} 1 & \dots & 1 \\ x_1 & \dots & x_m \end{pmatrix}\begin{pmatrix} 1 & x_1 \\ \dots & \dots \\ 1 & x_m \end{pmatrix} = \begin{pmatrix} m & \sum_{i=1}^{m} x_i \\ \sum_{i=1}^{m} x_i & \sum_{i=1}^{m} (x_i)^2 \end{pmatrix}$$

Now:

$$(X^tX)^{-1} = \frac{1}{\left(m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2\right)}\begin{pmatrix} \sum_{i=1}^{m}(x_i)^2 & -\sum_{i=1}^{m}x_i \\ -\sum_{i=1}^{m}x_i & m \end{pmatrix} \quad (11)$$

and:

$$B = (X^tX)^{-1}X^tY$$

$$B = \frac{1}{\left(m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2\right)}\begin{pmatrix} \sum_{i=1}^{m}(x_i)^2 & -\sum_{i=1}^{m}x_i \\ -\sum_{i=1}^{m}x_i & m \end{pmatrix}\begin{pmatrix} 1 & \dots & 1 \\ x_1 & \dots & x_m \end{pmatrix}\begin{pmatrix} y_1 \\ \dots \\ y_m \end{pmatrix}$$

$$B = \frac{1}{\left(m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2\right)}\begin{pmatrix} \sum_{i=1}^{m}(x_i)^2 & -\sum_{i=1}^{m}x_i \\ -\sum_{i=1}^{m}x_i & m \end{pmatrix}\begin{pmatrix} \sum_{i=1}^{m}y_i \\ \sum_{i=1}^{m}x_iy_i \end{pmatrix}$$

$$B = \frac{1}{\left(m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2\right)}\begin{pmatrix} (\sum_{i=1}^{m}(x_i)^2)(\sum_{i=1}^{m}y_i)-(\sum_{i=1}^{m}x_i)(\sum_{i=1}^{m}x_iy_i) \\ -(\sum_{i=1}^{m}x_i)(\sum_{i=1}^{m}y_i)+m(\sum_{i=1}^{m}x_iy_i) \end{pmatrix} \quad (12)$$

Thus, the formulas for the coefficients of regressions function are as following:

$$a = \frac{m(\sum_{i=1}^{m}x_iy_i)-(\sum_{i=1}^{m}x_i)(\sum_{i=1}^{m}y_i)}{m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2}, \quad (13)$$

$$b = \frac{(\sum_{i=1}^{m}(x_i)^2)(\sum_{i=1}^{m}y_i)-(\sum_{i=1}^{m}x_i)(\sum_{i=1}^{m}x_iy_i)}{m(\sum_{i=1}^{m}(x_i)^2)-(\sum_{i=1}^{m}x_i)^2} \quad (14)$$

In linear statistical models, the significance of the different factors represented by the independent variables is tested with the help of a technique called Analysis of Variance (ANOVA) [37].

The strength of the relationship between the dependent and independent variables can be determined by calculating the coefficient of determination (denoted by R^2) [38]. R^2 can be interpreted as the proportion of the variance in the dependent variable that is predicted by the independent variable. R^2 ranges between 0 and 1, indicating [27, 39]: 0 - the dependent variable cannot be predicted from the independent variable. A lower value implies that the dependent variables have some variance unaccounted for by the model; 1 - there is no error in the relationship between the dependent and independent variables.

Descriptive statistics are displaying Mean (the average value of the series), Median (the middle value of the series when the values are ordered from the smallest to the largest), Max and Min (maximum and minimum values of the series in the presented sample), Std.

Dev. (standard deviation who is measuring the dispersion or spread in the series), Skewness (a measure of the asymmetry of the distribution of the series around its mean), Kurtosis (who has calculated the peakedness or flatness of the distribution of the series), Jarque-Bera (a test statistic for testing whether the series is normally distributed)

The correlation matrix is another method used by E-views to make it easier to see that between some analyzed variables, there is or not a correlation.

B. Economic and mathematical models

3.1. CLV – CUSTOMER LIFETIME VALUE

CLV defined as the net present value of customers, but very few organizations can calculate the value of each customer. That's why the organization must analyze not only a customer but a whole customer segment. The organization needs to allocate specific budgets in analyzing segments and its life cycle (Fig. 1).

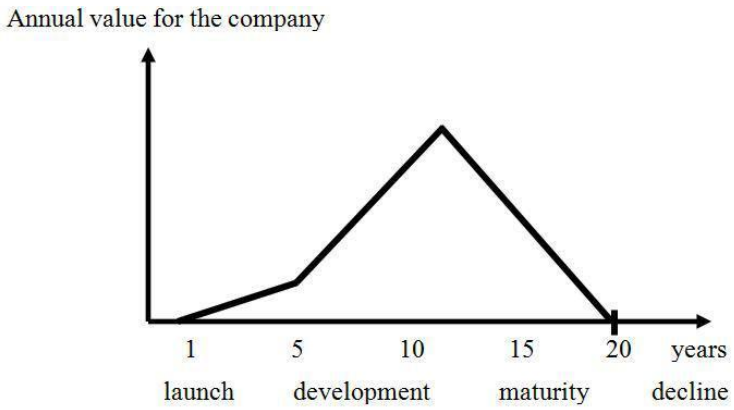

Figure 1. The total value of customers [38].

Knowing the value of a customer, the organization may have the opportunity to determine customers' loyalty. For many organizations, customer loyalty is the most critical determinant of growth and achieve long-term profit [40].

3.2. PCV – PAST CUSTOMER VALUE

It consists of extrapolating the results of past transactions in the future. Customer value is determined based on the total contributions made by the customers. Kumar V. [41] developed the following formula, necessary to decide on the present value of a customer by using past data about its buying behavior:

$$PCV = \sum_{t=1}^{T} GC_{it} \times (1 = r)^{t} \tag{15}$$

where: i= no. of clients, r =discount rate (12%/year, 1% per month), T=no. of current periods, GC_{it}=contribution of transactions (being 30% from the spent amount).

3.3. SOW – SHARE-OF-WALLET

Share-of-wallet (SOW) is a marketing metric [42], a key driver of business success [20], an increasingly important piece of information that databases provide [43], and a behavioral indicator of loyalty [44]. The basis of this analysis is a database with all the potential consumers in a market segment, their average annual expenditure for a particular product category, and the share of the company in the consumers' expenditure [45]. SOW measures the amount of money that a customer spends on a particular brand compared to other brands, indicating a preference for a brand and customer loyalty [41]. It suggests various customer groups' potential value, input for directing marketing, and guiding promotional programs [44]. It tries to capture the remaining wallet share of the competitors [46].

To calculate SOW, are needed [45]: a database with all the potential consumers in a market segment, information about their spending patterns to a particular product category, and accurate assignment of organization's revenue in a market segment to the individual consumer.

Its estimation can be made on three levels:

- at an individual level:

$$PCV = \sum_{t=1}^{T} GC_{it} \times (1 = r)^t \; ; \; SOW_{indiv} = S_i \div \sum S_i \tag{16}$$

Where: S= value of sales made in the analyzed organization, and $\sum S_i$= the number of sales made in all the organizations from the same category of a product.

- at segment level:

SOW - the revenue organization's share in the spending volume for a specific product segment.

- at organization level:

$$SOW = SOW_{indiv} \div No.\ of\ \ org\ \ consumers \tag{17}$$

3.4. MAD FU – MONEY, AUTHORITY, DESIRE, FIT, URGENCY

An organization can rank its customers and classify them according to five criteria, asking the following questions [47]:

M - the customers have enough money to afford a particular product?
A - they hold enough authority to decide if they can buy the product?
D - how intense is the desire of customers to purchase the product?
F - do they fit with the business organization?
U - the act of buying is an act of urgency?

3.5. BDF - BELIEFS, DESIRE, FEELINGS

SMEs can not afford to spend a large amount of money on market research, so they use the BDF formula, which says that you can understand the potential clients asking yourself three simple things [47]: What the potential clients think? Which are their attitudes? What do

the potential customers want? What are their potential customers' feelings? And which are their emotions? According to Benjamin Spock's quote: "Trust yourself. You know more than you think you might know."

3.6. DATA MINING

It is a relatively young and interdisciplinary field of computer science and a process of extracting patterns from large data sets by combining methods from statistics and artificial intelligence with database management [48]. Databases offer the opportunity of extracting ideas and information to discover models (neural networks, decision trees, statistical techniques, mathematical economic models, forecasting, and simulation), to extract valid, real, and useful information for making decisions and discover hidden relationships. Data mining is part of a more extensive process called "knowledge discovery" and can be used in the statistical analysis and modeling techniques and process simulation [9, 49]. Big data opens up possibilities to see correlations that were not visible before.

3.7. GEO-MARKETING

About 80% of all business-relevant info within a company has a relation to spatial data [5]. Communication with customers must be made according to socio-demographic characteristics (i.e., purchase behavior, location, and travel zone).

Geomarketing [50] allows organizations to advertise messages to be targeted based on local, regional, or national specificities to create a more substantial impact. Geographic Information Services (GIS) are [51]: functional elements offered by software entities through interfaces defined named sets of operations and information provision generated by geospatial data. Organizations which want to use GIS may encounter some obstacles [52] such as: obtain spatial data; recruit specialized persons; identify and choose the right type for GIS; assure the quality and the accuracy of data; mobilize financial resources, and create other databases to compensate the lack of the disponibility of spatial data.

3.8. RFM - RECENCY, FREQUENCY, MONEY

Segmentation depends on factors such as: the number of segments resulted; the impact of segments in time, segmentation techniques used, and the number of selected customers. Segmentation means a mix of specific characteristics: geographic, demographic, psychographic, and behavioral. Behavioral segmentation includes the RFM model and is offering more knowledge about each existing customer, their preferences, and a precise buying behavior prediction [53].

The method calculates a cumulative score in each customer's organization. The rating given is 0-15, 16-30, 31-45, and 46-60 points, which lead to the identification of the types of products purchased by consumers and shaping consumer organization for each product sold by the organization. One crucial task in marketing is to create a customer database that will include information such as name, gender, web, e-mail, advertisement, payment methods, address, city, country, postal code, phone number, and e-mail address. All this information are

also added the amount spent to purchase the product, the date on which the purchase was made, and how often they buy.

This information leads to RFM model development [39, 45, 51, 53]: R - last time when the client bought an organization product; F - how often a client buy from this organization; M - the amount spent by a client on a transaction.

RFM model [54] is simple, but efficient model in the application of market segmentation, to observe when, how often and much the customer spends to obtain a product form an organization [55].

This analysis may segment the customers and may optimize purchasing rates. The recently purchased, more frequently, and spent a more considerable amount of time, the possible actions to meet future promotion of the organization. The database contains more information; it's an effective marketing tool [47] and can help to determine the type of customers (Table 1).

Table 1. Databases with customers [47].

Databases (DB)	Types of customers	Characteristics
DB with present customers	- Followers - Consumers - Users - Prospectants	The most efficient
DB with potential customers	- Suspects - Possible - Potential	The most expensive

The organizations use the model to identify the "best customers" in the top 20 of all customers, with scores between 1 and 5 points in their database [56]. The customers are divided into categories, and the information help organization to select the clients who have proved that they are an essential source of profits. The points are accorded for R, F, and M as follows [55]: it is sorted descending the purchase date/number of transactions/amount and is given a value from 1 to 5 for each data set (5 – for the first 20%, 4 – for the next 20% of the following data).

4. EMPIRICAL DATA AND ANALYSIS

Today, more and more organizations are using data warehousing and mining techniques to market to their customers. Organizations increasingly recognize that past customer behavior, as recorded in actual business transactions, is by far the best indicator of future buying patterns [57]. Collecting e-mail addresses for a database can also be a way to prepare organizations to move down the track and build brand awareness [58].

Research objective: The main research objective is to show that not only the low price or the high quality attract and retain customers. Using MDB will help organizations to know better their customers and help them to offer a better, cheaper, and quicker a desired product/service.

Other objectives of this research are: To find out if there is a relationship between organizations that use MDB and customers who use the Internet to order online goods; To help organizations to know the value and the loyalty of a customer and to categorize customers more effectively through the use of databases, models, and technology; To show how information and customer database may increase profit and success for organizations; To find out who and why they buy and how much they spend on products/services.

In this case study, we propose to implement a simulation model to strengthen the relationships between customers using a marketing database. Starting from the fact that: peoples live in a digital world, where the Internet has a significant impact on many processes, including customer' buying; enterprises use marketing database to improve and strengthen the relationships with their customers; the marketing database represents a form of promotion that uses the Internet and the World Wide Web to deliver marketing messages to attract customers [59]. Therefore, was it proposed as the main objective and research hypothesis the following:

The main objective is to show the importance of using new technologies in creating a marketing database and in ordering goods and services online by the customers. A simulation model has been developed and consists of using regression function and E-views in order to find out if there is a relationship between using a marketing database by organizations and some independent variables which will be analyzed.

Research hypothesis:

1) H1 - There is a direct and positive relationship between using marketing database (A1) and the analyzed variables (A2, A3, and A4);
2) H2 - There is a normal distribution among the examined variables;
3) H3 - There is a correlation between the analyzed variables;
4) H4 - There is a normal distribution for residuals.

Sample selection: Data was collected for Romania and EU for the last 10 years (between 2007 and 2016) to make a comparison and to see the gap between the analyzed variables better.

In this study, the Tools used for analysis are: Linear Regression Model or OLS (Ordinary Least Square) (to test the impact of independent variables on dependent ones); Descriptive Statistics (to find out the normal distribution of the analyzed variables); Correlation Matrix (to find a correlation between the investigated variables); The design of data for this study was made by using E-Views (Version 7.0).

This article uses data gathered from 4 variables registered at Romanian and European level (EU28) necessary to make comparisons (Table 2).

Table 2. Variables influencing the MDB creation (RO/EU28) between 2007-2016 [60].

Year	Enterprises using software solutions like CRM to analyze information about clients for marketing purposes (A1)		Internet use by individuals (A2)		Individuals using the Internet for ordering goods (A3)		Individuals using Internet for finding information about goods and services (A4)	
	RO	EU28	RO	EU28	RO	EU28	RO	EU28
2007	14	17	24	57	3	30	12	46
2008	14	17	29	61	4	32	17	50
2009	13	17	33	65	2	36	12	52
2010	14	17	36	68	4	40	26	56
2011	13	18	40	71	6	42	27	56
2012	13	19	46	73	5	44	31	61
2013	11	19	50	75	8	47	26	59
2014	14	20	54	78	10	50	36	64
2015	15	21	56	79	11	53	26	61
2016	16	22	60	82	12	55	35	66

Table 2 represents the evolution of the four analyzed variables between 2007-2016. To better understand the trend of the analyzed variables, it was described them comparing with the pattern at the European level.

As indicated in Fig. 2, the evolution of the four analyzed variables is different at Romanian level compared to the average existent at European level (EU28): for A1 - there are differences between the values registered at Romanian level compared to EU28 level: from

21.43% (in 2007 and 2010) and 72.7% (in 2013), in 2016 is a gap between the enterprises who use MDB for customers RO/EU28 of 37.5% [60]; for A2 - there are differences between Internet use by individuals from 36.6% (2016) to 137.5% (2007) registered between RO and EU28. We observe that the gap continues to be low, due to the increasing number of individuals who use the Internet (now from 19.8 mil (population est. 2017) are 11.1 mil. Internet users, having a penetration rate of 56.3% face to Europe who has a 76.7% penetration rate (www.internetworldstat.com); or A3 - there are differences between individuals using the Internet for ordering goods between 358.3% (2016) and 980% (2007) registered RO/EU28. This difference is due to not trusting in ordering without seeing the product, to buy or to pay online (ec.europa.eu), due to the existent risks on the Internet; for A4 - there are differences between individuals using the Internet for finding information about goods and services between 88.5% (2016) and 283.3% (2007) registered RO/EU28. The gap, as we may observe, is reducing compared to EU28 but is remaining a critical difference (88.5%). This difference remains essential due to the reduced level of Internet skills from Romanian level (the second-lowest position according to the European statistics (www.eurostat.com) and DESI 2017 who is based on five indicators: connectivity, human capital, use of the Internet, integration of digital technology, digital public services ranking Romania on the last position from EU28 over the previous two years, even if it's classified the second to broadband access and the speed of Internet.

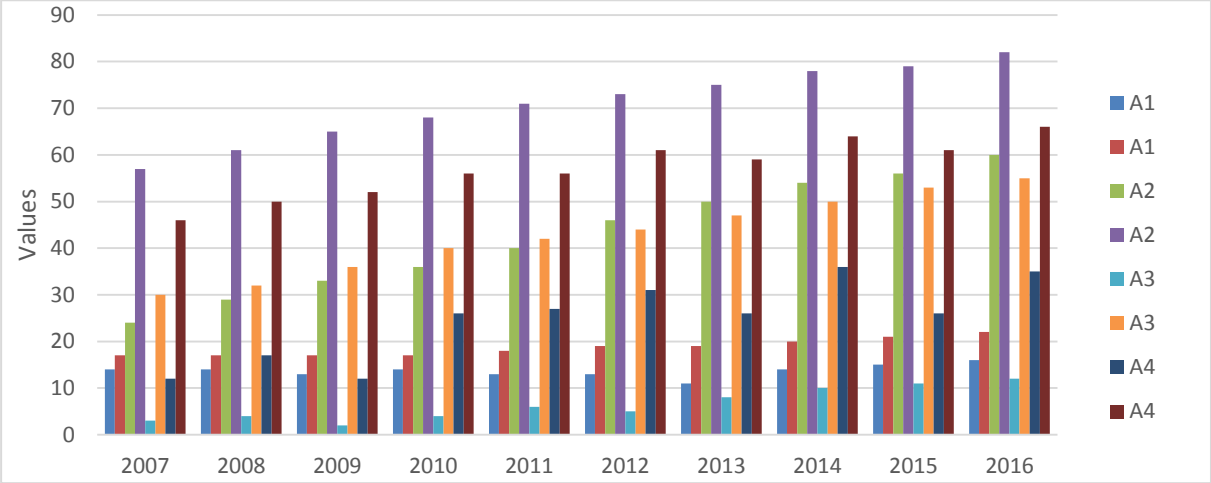

Figure 2. The evolution of analyzed variables in Romania and at EU28 level (2007- 2016) [61].

OLS Method

The coefficients of the above-analyzed variables can be estimated by using the OLS method. Using E-views 7 may be observed the relationship between creating and using MDB and the analyzed variables.

The regression function is:

$$y = C_0 + C_1 \times X_1 + C_2 \times X_2 + C_3 \times X_3 \tag{18}$$

where: y is the dependent variable and is considered A1-Enterprises using software solutions like CRM to analyze information about clients for marketing purposes (known as marketing database use); X_1, X_2, and X_3 - independent variables (A_2-A_4), which can be considered as having an essential impact on creating a marketing database; C_1-C_3- the slope (or gradient) of the straight line; C_0 - the intercept [29,39].

The strength of the relationship between the dependent and independent variables can be determined by calculating the coefficient of determination (denoted by R2) and is interpreted as the proportion of the variance in the dependent variable that is predicted by the independent variable.

R2 ranges between 0 and 1, indicating [29,39]: the dependent variable cannot be predicted from the independent variable, and 1- there is no error in the relationship between the dependent and independent variables. Using Eviews7, it could analyze the relationship between the investigated variables in the ANOVA test (Table 3).

In this case, we obtained the following values for the regression function:

$$A1 = 15.18 - 0.125 \times A1 + 0.019 \times A2 + 0.52 \times A3 \quad (19)$$

and it may be observed that R-squared is 31.8% (due to the lower values registered at the Romanian level compared to those noted as average at European level- EU28).

Table 3. The relationship between the analyzed variables using Least Squares method

Variable	Coefficient		Std. Error		t-Statistic		Prob.	
	RO	**EU28**	**RO**	**EU28**	**RO**	**EU28**	**RO**	**EU28**
C1	-0.125	0.101	0.11	0.17	-1.04	0.56	0.33	0.59
C2	0.019	0.574	0.09	0.2	0.198	2.24	0.84	0.06
C3	0.521	-0.473	0.34	0.35	1.51	-1.34	0.18	0.22
C0	15.18	21.18	2.36	8.01	6.41	2.72	0	0.03
Results	**RO**	**EU28**			**RO**		**EU28**	
R-squared	0.318	0.907	Mean dependent var		13.7		18.7	
Adjusted R-squared	-0.02	0.86	S.D. dependent var		1.33		1.82	
S.E. of regression	1.35	0.67	Akaike info criterion		3.72		2.35	
Sum squared resiv	10.96	2.77	Schwarz criterion		3.85		2.47	
Log-likelihood	-14.64	-7.77	Hannan-Quinn criter.		3.59		2.22	
F-statistic	0.93	19.7	Durbin-Watson stat		1.79		1.72	
Prob (F-statistic)	0.479	0.001						

Authors' calculation with the use of EViews 7 software

At EU28 level, R-squared is 90.7%, being a substantial and positive relationship between the analyzed variables. The standard error of the regression is very high, indicating that the forecasting error variance is enormous, and the model, although valid, explains the dependence between the dependent variable and the other independent variables taken into consideration. F statistic test has a value of 0.93, lower than the table value of 2.21, and the probability of 0.479 is minimal for utterly new research such as that undertaken in this article. All the tests performed to confirm that the assumption of homogeneity of the residual variable is met. From the formula founded by the computer simulation model results that A2, A3, and A4 are significant factors in the evolution of y (according to the calculation from EU28 level). Still, according to the data registered to Romania's level (which are very low compared to European data), these variables are not influencing so much the evolution of A1. To increase with a monetary unit, the A2 will get a decrease of 0.125 monetary units of A1, and an increase with a monetary unit of A3 will get a rise of 0.01 monetary units of y and a rise with 0.52 monetary units. We note that the value of the free term (15.18) is high enough, which allows us to conclude that the factors taken into account in the model construction have an essential impact on the evolution of y (being optimistic). The positive value of the free term reveals that the variables which were included in the econometric model have a positive effect on the evolution of y.

Thus, the hypothesis H1- There is a relationship between variable A1 and the other analyzed variables (A2, A3, and A4) is partially accepted, because it is a positive relationship but not strong enough (31.8%).

In conclusion, to obtain a more reliable connection between the analyzed variables, the values registered for A2, A3, and A4 must grow in the next few years, at least as the average for EU28. As may be observed, the values recorded for A2 in 2016 were increasing with almost 150% (24 in 2007 and 60 in 2016) but compared to the European values, these are lower with nearly 37% (from 60 to 82). Still, the values registered for A3 and A4 are not increasing so much, recording lower values (for A3 the difference is of 358.3% and for A4 the difference being of 88.57%).

Descriptive statistics

In Table 4 is presented a summary of the descriptive statistics using data between 2007 and 2016.

Table 4. Descriptive statistics for analyzed variables

Variables	A1	A2	A3	A4
Mean	13.70	42.80	24.80	6.50
Median	14.00	43.00	26.00	5.50
Maximum	16.00	60.00	36.00	12.00
Minimum	11.00	24.00	12.00	2.00
Std. dev.	1.34	12.25	8.60	3.53
Skewness	-0.31	-0.09	-0.36	0.36
Kurtosis	3.27	1.69	1.93	1.68
Jarque-Bera	0.19	0.73	0.69	0.94
Probability	0.91	0.70	0.71	0.62
Sum	137.00	428.00	248.00	65.00
Sum Sq. Dev	16.10	1351.60	665.60	112.50
Observations	10.00	10.00	10.00	10.00

Authors' calculation with the use of EViews 7 software

Table 4 shows the results of descriptive statistics for the analyzed variables during the analyzed period from 2007 to 2016. We observe that in the summary statistics were used mean, minimum, maximum, median, standard deviation (SD), skewness, Kurtosis, and the Jarque-Bera to analyze the sample during the period noted above.

All the analyzed variables present a positive mean value. The mean for A2 and A3 are higher than the others. 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 value, the ratio between mean and the median of each variable being approximately 1. The standard deviation compared to the mean is not low, which indicates a coefficient of variation. Also, the sum squared deviation row represents the net change over the sample period. It shows that A2, A3, and A4 increased very much, while A1 increased insignificantly, has an average increase. The variable A2 has the largest standard deviation among all the other analyzed variables. Also, the standard deviation (Std. Dev.) of the data series has small values for all the variables. Therefore, the series is relatively homogeneous. The results for A1, A2, and A3 are negatively skewed (the distribution is left-skewed), while A4 indicates a positive skewness. The value of Kurtosis is between 1.67 and 1.92 for A2, A3, and A4 being below the benchmark for a normal distribution of 3, which is positioned near normality, only for A1 is over this normal distribution (3.269). It is essential to show that three from four values of Kurtosis are smaller than 3, 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 0.18 and 0.94 (indicating that all the variables are approximately normally distributed), having associated probabilities closed to one indicating that the variables are volatile. So, the hypothesis H1- There is a normal distribution among the analyzed variables, was partially accepted.

Correlation matrix

E-views help us determine the relationship between the analyzed variables (Table 5).

Table 5. The correlation between the analyzed variables

Variables	A1	A2	A3	A4
A1	1.00			
A2	0.239	1.00		
A3	0.216	0.843	1.00	
A4	0.411	0.928	0.771	1.00

Authors' calculation with the use of EViews 7 software

The values presented in Table 5 show the strength of the relationship between the variables: if the value is zero, then the two variables are not related to each other at all; 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 two variables are very strongly related to each other; if the value is between zero and minus one, it means that there is a low correlation, and the two variables are a little related to each other or not at all.

As may be observed, the strongest correlation is between A2 and A3 (0.928) being closer to 1, A2, and A4 (0.843) and then between A4 and A3 (0.771). The relationship between A1 and A3 is strong enough. Still, the rest of the relationships are quite low but positive, having values of 0.216 and 0.239 (being registered between A1 and A2 and A1 and A4), motives explained above for each variable. Looking at EU28 level, the correlations between A1 and the other analyzed variables are robust (between 0.87 and 0.93), and between the different variables is between 0.95 and 0.99, showing a solid relationship close to 1. From these calculations results that the hypothesis H3-There is a correlation between the analyzed variables was accepted because between the analyzed variables do exist direct and positive correlations with no negative values, but not strong enough.

As a conclusion may be said that between the analyzed variables, there is a direct relationship but wick. To strengthen it, people must invest in having personal computers at home and in their online skills (even there is an increasing trend, the relationship is not strong enough). Having these skills, they could collect information about buying goods online and could order such goods online.

5. DISCUSSION

To highlight the importance of this research, here are some mathematical models adequate to implement to improve organization' relationships with its customers.

5.1. CREATING A MARKETING DATABASE TO IMPROVE PERFORMANCE

To have performance, organizations need an updated and clear map of the situation of the market, where the organizations are acting, and of their present and future customers. To do that, organizations need to collect data and create a database to determine the value and the level of loyalty of a customer (Fig. 3). Any type of organization can accomplish this, but this requires access to the databases of the organization related to products, customers, and sales. Where there are no such databases, the organization can form a database using any management system database. In this approach, to help organizations in marketing activity, a database was designed.

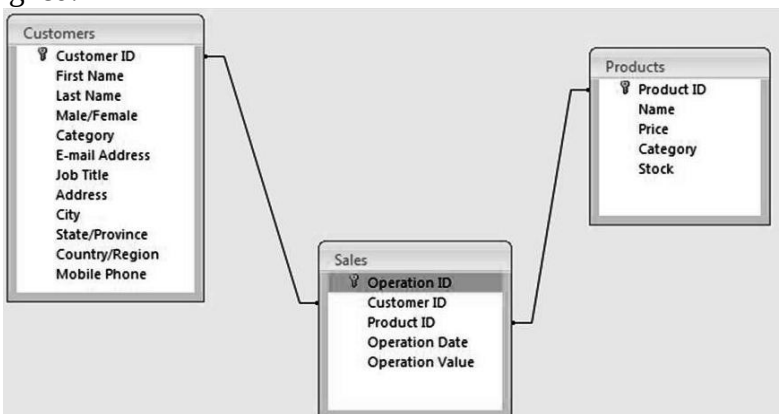

Figure 3. Defining DB and its relationships.

The relationships established between the DB will allow the processing of data through crossed queries (Fig. 4).

Customer ID	First Name	Last Name	Male/Femal	Category
100	John	Smith	Male	User
110	Albert	Willis	Male	Consumer
120	Sandra	McCabes	Female	User
130	Brenda	Jones	Female	User
140	Michael	Red	Male	Possible
150	Sandra	Diaz	Female	Possible
160	Michael	Willis	Male	Consumer
170	John	Cruise	Male	Possible

Product ID	Name	Price	Category	Stock
111	Bacon	10	Foods	100
112	Tomates	10	Foods	123
113	Cucumber	11	Foods	222
114	Potates	11	Foods	125
115	Olives	15	Foods	200
200	Wine	10	Drinks	100
201	Canola Oil	16	Foods	150
202	Soda	18	Drinks	170
203	Coca-Cola	6	Drinks	200

Operation ID	Customer ID	Product ID	Operation Date	Operation Value
10	100	111	5/10/2014	200
11	170	201	5/11/2014	100
12	170	111	5/10/2014	300
13	120	201	5/11/2014	200
14	130	111	5/12/2014	100
15	140	112	5/10/2014	300
16	170	115	5/11/2014	200
17	130	202	5/12/2014	100
18	130	111	5/13/2014	300
19	160	203	5/12/2014	200

Figure 4. Relations between the records from the tables.

By processing the data by the organization, can be determined different indicators to measure the value and customers' loyalty.

5.2. DEVELOPING MODELS TO HELP ORGANIZATIONS TO FIND OUT THE CUSTOMER' VALUE

Determining the PCV

The model and its calculation formula were presented above, so we determine the PCV directly for two analyzed customers (Table 6).

Are presented the spent amount for 5 months and must be forecasted for the next 2 months using PCV model.

$$PCV\ C1 = 72 \times (1 + 0.01) + 84 \times (1 + 0.01)^2 + 90 \times (1+0.01)^3 + 75 \times (1 + 0.01)^4 + 90 \times (1 + 0.01)^5 = 423.77 \quad (6)$$

From calculations, results that customer C1 is worthing 423.77 m.u. (monetary units) in the total contribution. However, it does not demonstrate that he would be active in the future, nor to determine the costs of retaining the customer relationship in the future [41].

Table 6. Forecasting the contribution of a customer using PCV.

Customer 1	**Month 1**	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Forecast Month 6**	**Forecast Month 7**
The spent amount (SA)	300	250	300	280	240	273.33	264.44
GC (30% from SA)	90	75	90	84	72	82	79.33
PCV for C1	423.77						
PCV forecasted for C1	419.95						

Customer 2	**Month 1**	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Forecast Month 6**	**Forecast Month 7**
The spent amount (SA)	200	270	300	350	450	366.67	388.89
GC (30% from SA)	60	81	90	105	135	110	116.67
PCV for C2	483.53						
PCV forecasted for C2	572.98						

Authors' calculation with the use of Excel 2019

The forecasted method for this analyzed customer it is as follows:

$$SA\ forecasted\ for\ M6 = (300+250+300+280+240)/5=273.33 \quad (7)$$

$$SA\ forecasted\ for\ M7 = (250+300+280+240+273.33)/5=264.44 \quad (8)$$

Making the same formula for the spent amounts but also the new values forecasted above, we obtain, using Excel calculation, a forecasted PCV for C1 of 419.95.

It was repeated the calculation for the second customer, and it was obtained values for M6 and M7 of 366.67 and 388.89 and making the calculations again; it was accepted value for PCV C2 as being 483.53 and PCV forecasted as being 572.98. Now, are representing the general contribution for the two analyzed customers graphically (Fig. 5).

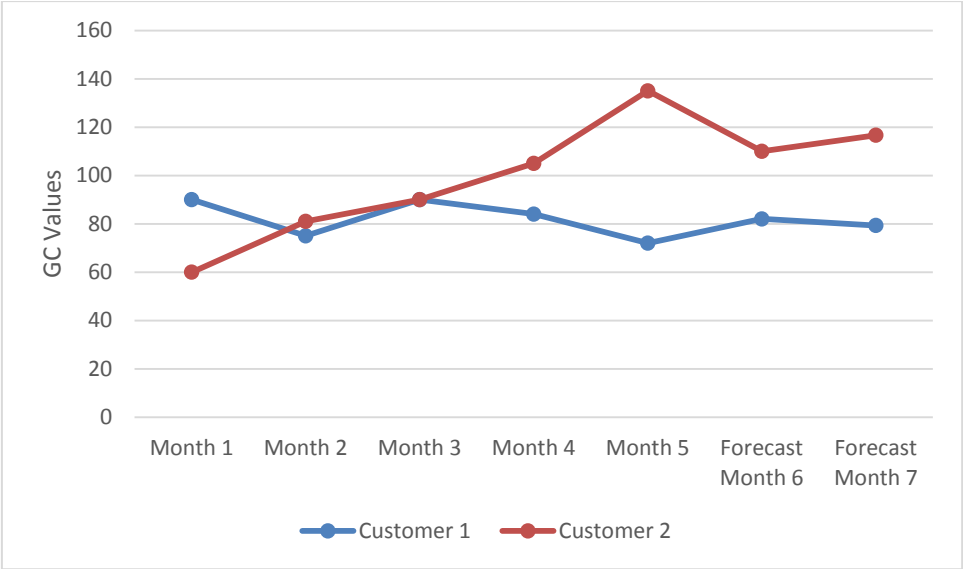

Figure 5. Comparative representation of clients transaction.

It can observe that the second customer, even it started with a lower SA, is more valuable for the analyzed organization (Fig. 5) and is worthing 483.53 m.u. compared to 423.77 m.u. from the total contribution. Even if the forecasted value is more important for the second customer, the model enables the comparison of the transactions of more customers (in our case two customers) and provides organization with new directions, such as: improve customer relationships that have trades on an ascending line and offer precious information about new or complementary products, new services or reduction of pricing of the desired results; or improve the techniques of attracting new customers and promote sessions for customers whose transactions are on a descending line.

Determining the amount of money that customers spend on the same product (SOW-Share-of-wallet)

Data processing takes into account the sales of some products over some time (Fig. 6); this is requiring a correlation between sales data and product data. Results can be represented in a table or graphic form (Fig. 7).

Product ID	Name	Category	Top Value
111	Bacon	Foods	1100
202	Soda	Drinks	700
115	Olives	Foods	400
201	Canola Oil	Foods	300
112	Tomates	Foods	300
203	Coca-Cola	Drinks	200
114	Potates	Foods	100
113	Cucumber	Foods	100

Figure 6. Determining the sales over time.

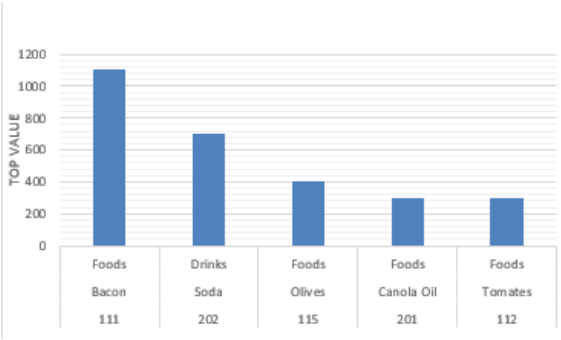

Figure 7. Top sales for 5 products.

The organization analyzes this data and can see its 5 top five customers. The organization may offer these customers lower prices, new information, new products, or even new services.

For example, a customer buys three products valuing 2500 m.u. from company Y, of a total of 4,000 m.u. They were spent on food from other companies.

$$SOW = 2500 \div 4000 \times 100 = 62.5\% \quad (9)$$

from the amount spent on organization Y. Using this indicator, we may observe that the customer is strongly attracted by one brand compared to other brands.

Determining the geographical location of customers (Geo-marketing)

An organization, to know more about its clients, creates geo-marketing databases and graphic representations, to make decisions, according to this characteristic. For example, a bank if it wants to advertise credit students, it must do that in those areas where the students are, and if it intends to promote real estate credit, it must do that where the majority of families rent their homes. Such territorial strategies are taking into account the geographic criterion for a better adaptation and in order to improve relationships with customers (Fig. 8). Processing, which may take place on customers' data and by city, it can be obtained using a distribution chart which can be used in campaigns targeting promotions. All through the geographical location can be analyzed customer affinity for a particular category, for example, a rural area or urban area (Fig. 9).

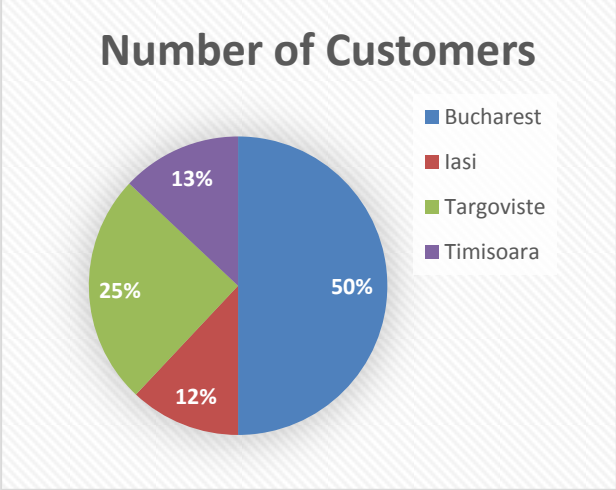

Figure 8. Dividing customers by travel zones.

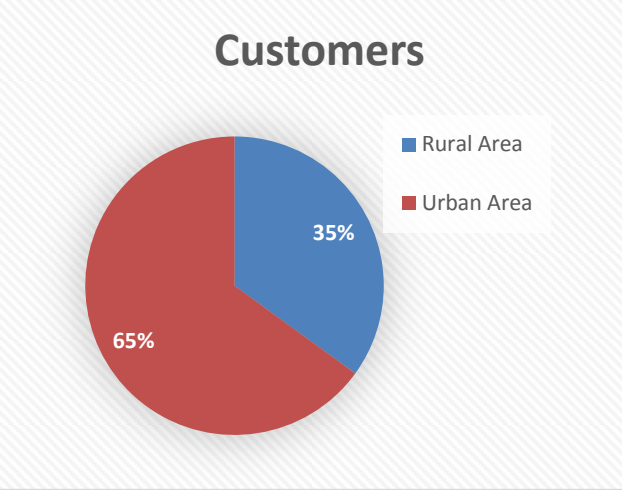

Figure 9. Dividing customers by areas.

Another example is given below (Fig. 10) using different criteria used to choose a workplace and different area locations (three analyzed regions).

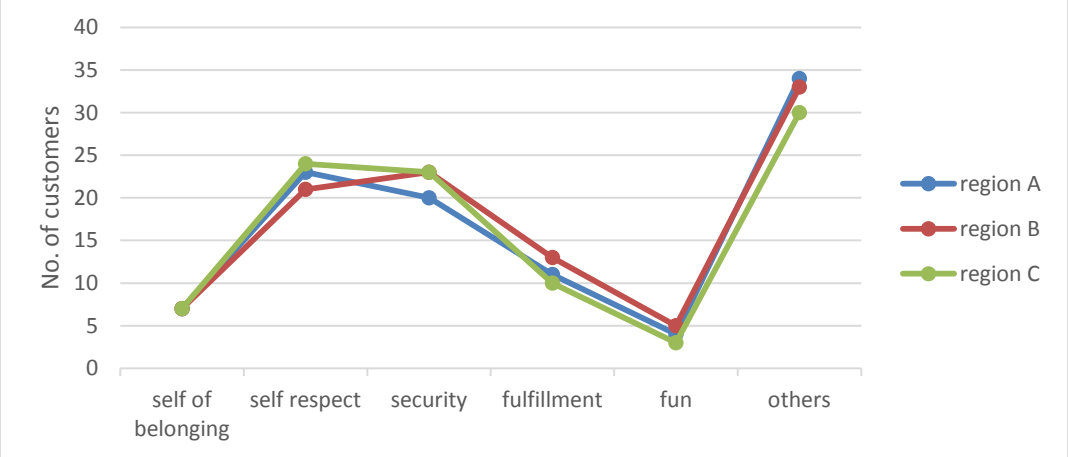

Figure 10. Dividing customers by regions and values.

Segmentation data to meet the query (RFM or FRAT): Database query can determine answers to various questions about the marketing strategy and offer guidance to customers following the product.

Viewing sales of a certain customer. By processing data, it can get a report (Fig. 11) that will display the products purchased by each customer in this way: the amount of money spent, the latest shopping, the purchase frequency, etc.).

Sales by Customers

Customer ID	First Name	Last Name	Male/Female	Category
100	John	Smith	Male	User

Operation ID	Operation Date	Product ID	Product Name	Operation Value
10	5/10/2014	111	Bacon	200

Customer ID	First Name	Last Name	Male/Female	Category
110	Albert	Willis	Male	Consumer

Operation ID	Operation Date	Product ID	Product Name	Operation Value
22	5/14/2014	111	Bacon	200
25	5/12/2014	115	Olives	200

Customer ID	First Name	Last Name	Male/Female	Category
120	Sandra	McCabes	Female	User

Operation ID	Operation Date	Product ID	Product Name	Operation Value
23	5/12/2014	114	Potates	100
13	5/11/2014	201	Canola Oil	200
24	5/14/2014	202	Soda	300

Figure 11. Sales by customers using RFM.

Viewing the categories of customers. By processing, data can be obtained lists of each category of customers (Fig. 12) to guide promoting products and/or increasing the rate of acceptance of certain products.

Category of Customers

Customer ID	First Name	Last Name	Job Title	Category
100	John	Smith	Manager	User
120	Sandra	McCabes	Engineer	User
130	Brenda	Jones	Housekeeping	User
3				

Figure 12. Category of customers using RFM .

Viewing the number of purchases made by a customer. Processing can identify the number of purchase transactions made by a customer to a particular class/category of customers. Data can be grouped by category of customers or in order of operations (Fig. 13).

Number of Sales

Customer ID	First Name	Last Name	Category	Number of Sales
100	John	Smith	User	1
110	Albert	Willis	Consumer	2
120	Sandra	McCabes	User	3
130	Brenda	Jones	User	3
140	Michael	Red	Possible	1
150	Sandra	Diaz	Possible	1
160	Michael	Willis	Consumer	2
170	John	Cruise	Possible	3

Figure 13. Determining the number of sales using RFM.

Displaying the value of all operations performed by a client. The resulting data can be presented in a table form, report, or chart (Fig. 14) and reflect the total amount of transactions each client assigned to a particular class of customers. The role of these results is to identify and reframe customers from one group to another.

Customer ID	First Name	Last Name	Category	Operation Value
170	John	Cruise	Possible	600
120	Sandra	McCabes	User	600
130	Brenda	Jones	User	500
110	Albert	Willis	Consumer	400
160	Michael	Willis	Consumer	300
150	Sandra	Diaz	Possible	300
140	Michael	Red	Possible	300
100	John	Smith	User	200

Figure 14. The total amount of transactions each client assigned to a particular class of customers using RFM.

Determine the product sales at a certain date. Processing covers the products which have been purchased by customers on a particular date or time (Fig. 15).

Operation Date	Product ID	Name	Products.Cat	Customers.C
5/10/2014	111	Bacon	Foods	User
5/10/2014	111	Bacon	Foods	Possible
5/10/2014	112	Tomates	Foods	Possible

Figure 15. Product sales at a certain date using RFM.

Using these models based on marketing databases organizations may: determine which customers may offer performance and value; discover the ability to develop customer-centric strategies and products that may lead to performance and customer satisfaction; determine the ability to create theories and economic models to increase performance using strategies focused on price; have the opportunity to use forecasting, simulations, and models; implement the analysis of customer portfolio or of the occurrence of risks necessary to develop cross-selling, increase customer loyalty, and satisfaction.

6. CONCLUSIONS

The main conclusion is the necessity of using the economical and mathematical models for managerial applications on decisions at the company level and B2C marketing. The implications have not only impact on present actions but also on future actions, based on using predictions and forecasting due to the implementation of simulation and modelling (using regression function, OLS, ANOVA, R-square which may help practitioners to improve performance based on past data). Due to the use of new technologies and the fact that we live in a digital world, where the Internet has a significant impact on many processes, including customer' buying, the managerial implications are improving the enterprises' use of marketing databases and strengthening the relationships with their customers. Some substances are also practical. Organizations have realized that they know little about their customers. Getting closer, using models of analysis, and dividing them into groups with different characteristics, requirements, and behaviors, the organizations will have the

opportunity to obtain success. Then, the models used in our study, for example, CLV, PCV, and SOW need special attention in the literature. Models used should be developed that fit into the new age of virtual marketing using e-skills.

Using databases in a changing environment, where external factors influence the customers' behavior, the organizations can design measures and develop models, to find out the value and customer loyalty. Marketing databases developed and described in this study will provide a new way of using IT and implement it in the organizations that wish to improve business relations with customers and to satisfy their ever-changing needs. Relationship Technology will become the new key element for the use of information and customer knowledge, which shows the importance of relationships between organizations and customers. We can accomplish this through advanced technology, developing new methodologies and processes based- customer and channels, combined in such a manner that influences the behavior of the organizations and the behavior of customers, to obtain profit, on one part, and satisfaction and utility, on the other part.

This research has some limitations. First, we made our study just using four analyzed variables and just for 10 years of analysis. Future research may also use other variables and a longer horizon of time for analysis. Second, our study is limited to just one country- Romania, but we made a comparison with the EU level to see the existent gaps necessary for future improvements. Future research could extend this study in other European countries, to help make comparisons between them, which may offer pertinent information about the stage of implementing MDB.

Having long-term relationships with customers means understanding and influencing their behavior through effective communications to increase acquisitions, retention, loyalty, and profit. Creating different models to understand these behaviors, believes, and needs, the organizations will satisfy them and, implicitly, it will obtain a competitive advantage.

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