RESEARCH ARTICLE

CAN A COMPANY INCREASE ITS PROFITABILITY BY STUDYING THE BEHAVIOR OF ITS CONSUMERS?

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ARTICLE INFO	ABSTRACT
	The purchase decision process began to be studied 300 years ago by John von Neumann and Oskar Morgenstern. Over time, due to the social and demographic changes and the fast evolution of technology, people needs became more diverse and so, a new science was developed in 1960: Economic Behavior. The study of consumer behavior is now an important issue for any company that wants to expand its dimensions, to become more competitive and ultimately to survive to the daily changes of the economic environment. The goal is to create a model that will improve the profitability of companies by increasing the number of products sold by the company and by creating stronger relationships between the company and its customers. In conclusion, by studying the behavior of their clients, companies can deliver products in a more efficient manner, increasing consumer satisfaction and ultimately, increasing their profitability.

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INTRODUCTION

Consumer behavior has become in the last decade one of the most important aspects studied by companies and economists around the world. The main causes for this phenomenon are the growth of population and the rapid development of technology, both of them leading to diversification of people's needs. Currently, all large companies have developed their own methods in order to identify consumer needs and predict their behavior. By doing these, they want to increase the profitability by gaining the loyalty of the current customers and not by increasing the number of clients (the main reason is that gaining a new client is more expensive than keeping an actual client). The main goal of this paper is to develop a model which can anticipate the needs of consumers and propose them personalized offers that will satisfy those specific needs, in the end increasing the sales of the company. In this article I describe an algorithm that can be used by any company, regardless of its field of activity, to create personalized offers for their clients. The algorithm is implemented in the SAP Program and according to few parameters like, field of activity or number of products that should be included in the offer, it generates an offer for each client. The offer includes 4 types of products: products that were already bought by the client, products complementary to those already bought, products bought by other clients with a similar shopping cart and specific day products (like Easter or Christmas products). In this way, it is encouraged the purchase of more products from the same category, and the diversification of the shopping cart. By increasing the number of products sold, the profit of the company increases. Section 2 reviews some of the research literature concerning the evolution of consumers behavior and presents some solutions that should be adopted by enterprises in order to adapt to these changes. Section 3 presents in detail the main steps of the model created in order to generate personalized offers. Section 4 and section 5 describes the program and presents some simulations of the model. Section 6 contains the conclusions of this article.

Literature review

Evolution of consumer behavior; what should companies do?: Consumer behavior is an emergent phenomenon that evolved along with human development. During the prehistoric age, the human behavior occurred in a very limited way, people being grouped in small families with the only concern of surviving. Much later, people began to develop social skills that eventually led to the emergence of money, social status, wealth and ultimately to shaping consumer behavior.

The evolution of consumers' psychology is carefully studied by Geoffrey Miller (2005), one of the most famous contemporary psychologists who tried to surprise the chain of causation that led to the current consumer behavior. The purchase decision process began to be studied about 300 years ago by Nicholas Bernoulli (in 1783 he introduced the terms of expected utility and marginal utility in the economic theory), together with John von Neumann and Oskar Morgenstern (they introduced the terms of risk and uncertainty, and in 1944 they published one of the most important papers in economics "Theory of Games and Economic Behavior"). They created a mathematical model in order to determine the utility gained during the decision making process, people being considered pure rational beings. Although, recent research have shown that there are a lot of other factors that influence the purchase decision, besides the rational ones, like social, cognitive and emotional factors. By taking these factors into consideration when modelling the purchasing decision process, a new, interdisciplinary and emerging science appeared in 1960: the study of consumer behavior.

Behavioral economics is an interdisciplinary science that integrates information from psychology (the study of factors that determine an individual to purchase a product), sociology (the study of group dynamics in acquisition of products), social psychology (how a person is acting in a group and his effects regarding the purchase activity), anthropology (the influence of the purchasing activity on cultural and intercultural environment), economics (income and purchasing power) and artificial intelligence (the study of the interaction of neurons in shaping consumer behavior) (Pachauri, 2002). The main cause that triggered the study of consumer behavior is the diversification of needs. This diversification is primarily influenced by the exponential growth of population; an association can be observed between the moment when behavioral economics distinguished as a science and the moment when the population started to record a strong upward trend. This is also the period when travel became accessible on large scale due to the mass production of cars and commercial aircrafts. Because of that people had the opportunity to travel and discover other cultures and as a result their needs were diversified.

Thus, if half a decade ago, the majority of population lived in small towns, with limited opportunities to leave their community, and less varied needs, now, due to the evolution of technology and the demographic changes, consumers are starting to have increasingly more diverse needs. These changes of consumer behavior had strong influence on all companies, the mid-70s becoming the moment when the law of demand and supply changed the macroeconomic environment: if half a century ago the markets were lead by sellers, now the control of markets dynamics belongs to the buyers, who gained the power of negotiation. The technological evolution of the last decade has led to significant changes in consumer behavior, not just in the sense of increasing the number of products from which the consumer can choose in order to satisfy his specific needs, but also in the sense of changing the manner in which consumers buy products and services. From marketing point of view, the transition from capturing consumers attention through TV commercials to capturing consumers attention via Internet must be made. Large enterprises, which are complex adaptive systems, have already begun to adapt to these changes, accepting the technological innovation, the co-evolution between technological

development and the manner of approaching the consumer. Considering all these aspects and the fact that most products created lately are becoming more and more specific (today, the customer has the possibility to personalize his product or service to the smallest details), the next step that companies should do would be to create customized offers for each client. For this I have developed a model that will create specific proposals for every customer of a supermarket. The model is implemented by using an algorithm developed in the SAP program. In the next chapters I describe the steps of the algorithm, its implementation with the SAP program and some examples obtained during the simulation process.

MATERIALS AND METHODS

Main steps of the algorithm that creates personalized offers for the clients

The goal of the model is to increase the profitability per client using follow-ups - sending emails with personalized offers. Basically, it aims to increase the sales both by increasing the amount of the same product bought and by increasing diversity (more kinds of different products).

In order to create this model, answers for the following questions need to be provided:

- Which client should receive an offer by e-mail?
- What products/services should be included in the offer?
- In which categories can the products/services be divided in?
- How to prioritize the products/services included (layout of the offer)?
- When and how often should the offer be sent, so that the client does not get irritated by the frequency of the offers, while his interest to return to the supermarket is maintained?
- By answering these main questions and using Data Mining concepts, I identified the main steps of the algorithm. First, the information obtained from previous transactions is processed thus achieving a representative database. Then, the model tries to understand the customer behavior by studying his shopping cart and identifying a specific pattern. It also makes correlations between various clients in order to diversify customer's shopping cart (proposing products that until then had not been purchased by that client, but have a high probability to be desired by him). In the end, it makes predictions based on which personalized offers are issued for the customer. The program runs the algorithm every day, identifying each eligible client that can receive a personalized offer. The main advantage of this program is that it can be adapted to the specific business of each company.

Determine the eligible clients that can receive a personalized offer: The eligibility of a client is set according to the frequency of shopping, based on the assumption that a customer that buys from a particular company more often considers the offers being more useful (basically you do not want to irritate the customer by sending too many offers that could lead to losing him). In the current marketing environment, sometimes companies use aggressive campaigns to win customers (the multitude of commercials on TV that
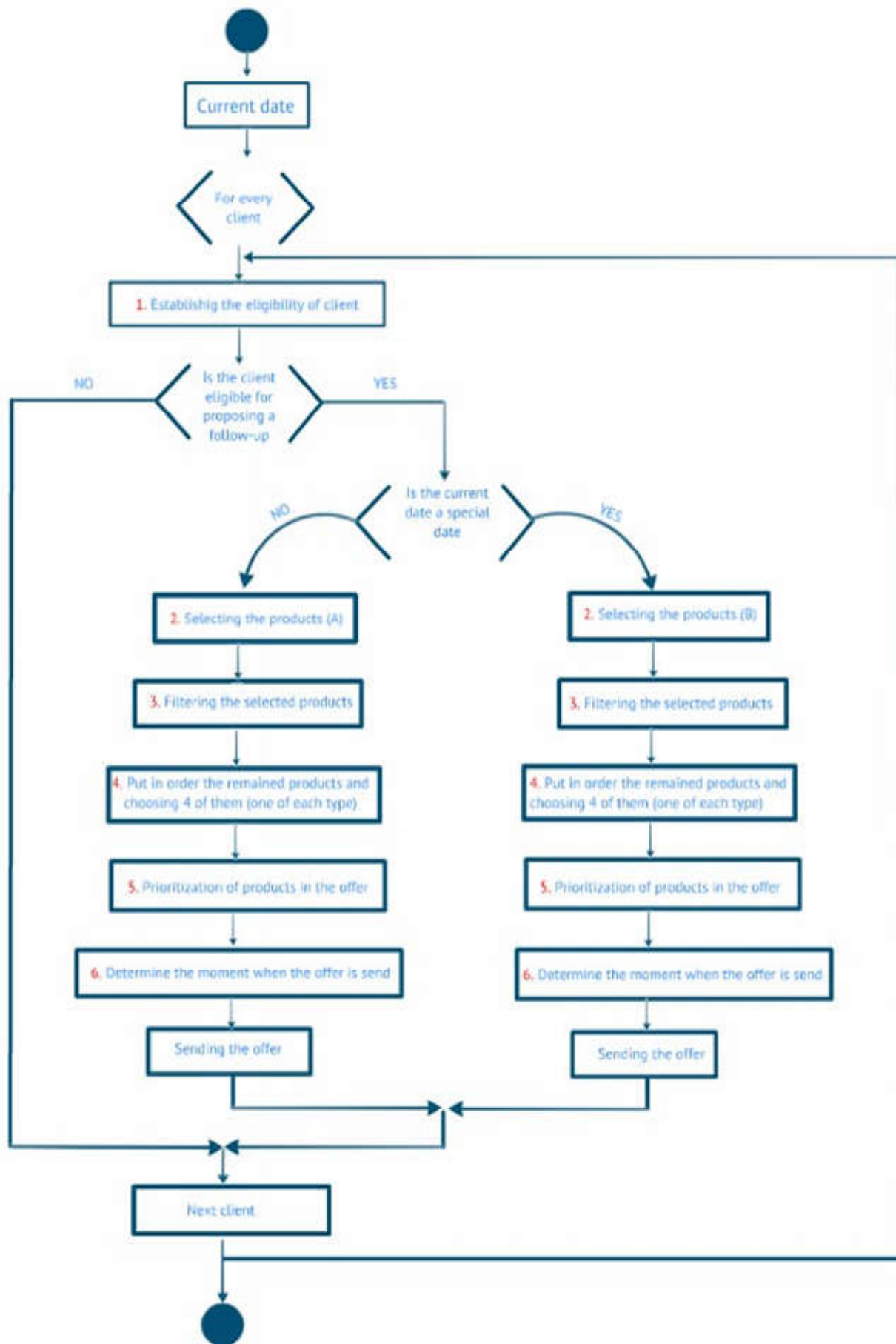
Source: author's creation

Figure 1. Flow chart of the algorithm
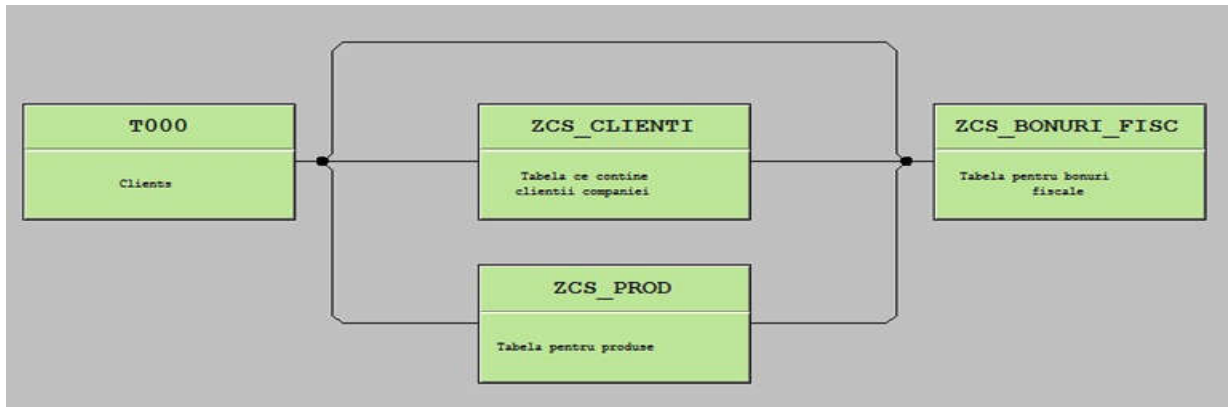
Source: SAP output (author's creation)

Figure 2. Connections between the tables

Source: SAP output (author's creation)

Figure 3. The clients of the virtual company (records from table ZCS_CLIENTI)

Source: SAP output (author's creation)

Figure 4. The products of the virtual company (records from table ZCS_PROD)

Source: SAP output (author's creation)

Figure 5. The complementary products (records from table ZCS_PROD_COMPL)

Source: SAP output (author's creation)

Figure 6. The bills of the virtual company (records from table ZCS_BONURI_FISC)

Source: SAP output (author's creation)

Figure 7. The selection screen of the simulation

Source: SAP output (author's creation)

Figure 8. The results of the simulation

often interrupt programs, the frequent phone calls from companies that verify customer satisfaction, the multitude of flyers), so the client has become sensitive to the manner that a company promotes its products and services and so selection of products have changed significantly in recent years (often an advertisement may cause the client to no longer want to purchase the product).

The shopping frequency for every customer is determined as the ratio between the unit of time taken into consideration by the company and the number of orders made by the client. The unit of time is determined according to the products sold by the company: if it sells electronic devices the time unit is larger than if it sells food, mainly because the consumption time is different between the 2 products.

For example, if the time unit is one month (28 days) and the number of orders made by a customer is 4, the shopping frequency is a week (7 days), so the offer is sent weekly to the client. A customer is eligible to receive an offer if the last date when he received one cumulated with the shopping frequency exceeds the current date (the date on which the algorithm is executed).

Identify all products that can be proposed to an eligible client: First, all the products that can be offered to the eligible client are selected, but only few of them are inserted in the final offer. The products are framed in four categories:

- Date Specific Products, only if they exist (for example, products for holidays such as Christmas or Easter, or important events such as the Olympics or the launch of a movie);
- Identical Products, that were previously purchased by the customer;
- Complementary products to those previously purchased by the customer (for example, if the customer previously purchased a mobile phone, a complementary product could be a phone case);
- Other Products, with no direct connection to the previously purchased items, which are found by identifying patterns between all the customers of the company (in this regard the historic database is used).

Filter the selected products: In order to filter the selected products first the consumption period for each of them needs to be defined. For volatile products the consumption period is represented by the unit of time in which they are consumed (for bread the validity date, for rice two weeks), while for non-volatile products the consumption period is the warranty period. The moment when a product is eligible to be included in an offer is determined according to the consumption period. In order to do that a follow-up gap which is the sum of consumption period and shopping frequency multiplied by a constant is calculated (the constant is directly proportional to the consumption period). Products are filtered by their characteristics and the possibility of including them in the offer.

A product that has already been bought previously (identical product) is selected if the last time of purchasing plus the consumption period and the last time when the product was placed in an offer plus the follow-up gap are greater than the date when the algorithm runs (current date). The other types of products (complementary or date specific) are added only if the date of the last follow-up plus the follow-up gap exceeds the current date. So, for a product already ordered it also has to be taken into consideration the last time when it was ordered (it is assumed that the consumer will not buy the same product before removing it; for example if a person bought a phone, there is be no sense to propose him another phone before the warranty expires, or the company would risk promoting the idea that its products are of poor quality). The most important characteristic of a product is its price. Basically the price is the most sensitive component for a consumer, and he will never purchases a product or service that does not fall within certain limits. A product type can be offered by a company at different prices. For example, suppose that one of the products that can be added to the offer is oil. In a supermarket this product can be found at different prices depending on the company that produces it and the type of oil (sunflower, olive, coconut, etc.). The product with the most appropriate price should be proposed to a specific client.

Sorting the final products inside the personalized offer: The number of products that can to be included in an offer is between 4 and 10, number that is determined for each company depending on the activity it carries. For example, companies with a wide range of products (supermarkets) could offer 10 products very diverse, from bread to refrigerators, while a company that sells phones can offer a maximum of 4 products because the product range is much limited (there is no sense in proposing 10 mobile phones for a single client). Then it must be established how many products from each category are inserted in the offer (how many specific products, how many products previously purchased, how many complementary products and how many products different from consumer shopping cart). If the maximum number of items is 4 then one product from each category will be selected. If the maximum number would be 10, the optimal situation would be: 2 specific products, 4 products previously purchased, 2 complementary products and 2 different products from consumer shopping cart. The prioritization is based on the type of products, in the following order: specific date products, identical products, complementary products and different products. Specific date products are placed on top of the offer while different products are placed on bottom of the offer because the probability of being purchased is smaller. In addition, if it is noticed that a particular client never buys a different product, then this class of products could be eliminated from the offers of that client.

Identify the date and time when the offer can be send by e-mail: One of the least expensive and the most effective method to propose offers is through the e-mail, and the moment when the offer is sent is very important. Today, companies send email for various occasions (promoting new products, informing about a new campaign or sending different offers), which is why many consumers get daily information that don't present any interest. Often emails are not read or even opened. Therefore, the moment of day when the mail is sent and the layout of the offer are very important in capturing consumer attention. A day is divided into three clusters: class 1 from 2 a.m. at 10 a.m. (for people who check their e-mail in the morning or when they arrive to work), class 2 from 10 a.m. to 6 p.m. (for those whose job is conducted through the e-mail or check their e-mail while they are at work) and class 3 from 6 p.m. to 2 a.m. (for those who check their e-mail in the evening or at night). For the cluster in which the client was the most active (made most shopping) the program calculates the averaged of the moments when the customer made shopping and the result represents the moment when the offer is send. Finally, the client receives a personalized offer when he has the highest willingness to buy. Therefore the company encourages the purchase of products that were already bought before, increasing the sales of products from the same category, and also encouraging the purchase of complementary products and different products, ultimately increasing the diversity of sold products.

Proof of the model

Will the model increase the profitability of companies?: The long-term goal of any company is to permanently adapt to the constantly changing economic environment, while the

short-term goal is to make profit. When the profit is higher, the probability for the firm to survive to the turbulences of the economic and financial environment increases. The profitability of a company is its ability to obtain profit after paying all expenses, exemplifying through its indicators the "health of the business". To determine the profitability of a business, an analyse of all internal and external factors that influence the activity of the firm is needed, thus emphasizing the relationship between effect and effort. Also, an evaluation of the general context of the business environment and the local context of the market in which the firm operate, must be made. The profitability of a company can be improved by lowering expenses or increasing income.

The most effective means of doing so, would be: improving sales activities, efficient planning, increasing average sales value of products which generate profit, selling products and services with high profit margins and continuous focus on the demand and competition. The described algorithm above takes into account all of the methods listed above. By dividing the products in 4 categories (specific day products, identical products, complementary products and different products) the model improves the sales activity and by selecting and prioritizing the products according to previous purchases made by the customer and the similarities between the shopping done by the client and other clients of the company, the model boosts the sale value and eliminates the products that do not generate profit. In conclusion, the proposed model increases the profitability of the company.

Short presentation of the program and simulation of the model: The model described above, which creates personalized offers for every client of a company, is implemented using the SAP program (System Applications and Products). This program is currently one of the most important ERP programs (Enterprise Resource Planning) and a world leader in providing solutions for business. This is a complex program which can develop programs for areas such as: Accounting, Customer Relationship Management (CRM), Supply Chain and Procurement (SCM - Logistics), Banking, Insurance, IT Infrastructure or Human Resources. The main advantage of this program is that it offers specific solutions adapted to each company's business activity. By implementing this system, a company gains the visibility necessary to eliminate inefficiencies and achieve competitive advantages, the vision to quickly identify new business opportunities and agility to respond to changing economic realities. It also has the functions necessary to optimize operations and resources to extend best practice business in the entire value chain. Therefore, the unique advantages are rapid implementation of the system and providing implementation services and maintenance. The program is a combination of database warehouse and classical programming. It contains standard applications that can be applied to all companies, no matter the sphere of activity. Those applications can be personalized according to the needs of the client. The tables created for the simulation are the following (although the program already had similar standard tables, because they contain unnecessary fields, I preferred to create my own tables, with less fields, in order to be able to make the simulation):

- a table for clients ZCS_CLIENTI (the standard table is KNA1);
- a table for products ZCS_PROD (the standard table is MARA);

- a table for complementary products ZCS_PROD_COMPL (standard table does not exist in SAP);
- a table for Bills in order to keep the historic data ZCS_BONURI_FISC (the standard table is VBAP).

The main table, which connect all other tables, is the Bills table ZCS_BONURI_FISC, as it is shown in the next figure (the Bills table contains information about the products, and the clients who bought them, so it is a link between this tables).

Table ZCS_CLIENTI contains 10 fields:

- MANDT – this a specific field for tables in SAP program that identifies the client which log on the system, and is mandatory;
- ID_CLIENT – this field uniquely identifies the customers of a company;
- NUME – this field contains the surname of the client;
- PRENUME – this field contains the first name of the client;
- TARA – this field contains the country where the customer live;
- ORAS – this field contains the city where the customer live;
- TELEFON – this field contains the phone number;
- FAX – this field contains the fax number;
- ADRESA – this field contains the address where the customer live;
- EMAIL – this field contains the e-mail address of the customer.

The first 6 fields are mandatory, while the last five aren't (these are confidential data, that some clients don't want to give). Companies can obtain these data by making special cards for each client. For example, in case of supermarkets, if a client don't have such a card he can't buy products from SELGROS and he can't have specific discounts at CORA. Form marketing point of view the second example is a better one (the example with Cora) because it doesn't oblige the client to make a card; he makes it only if he is a long term client and wants to benefit from the facilities the company offers. For the simulation, this table is filled with 6 records:

Table ZCS_PROD contains 18 fields:

MANDT and ID_PRODUS uniquely identifies a product;
NUME is the name of the product;

TIP_PRODUS and GROUP_PRODUS classify the products in different categories;

- next 8 fields are technical characteristics of the product: weight, volume, length, width, high and units of measure;
- VALAB_INIT and VALAB_FINAL contains the validity dates;
- ZI_SPECIALA is a field which contains the code for special events (for this simulation 3 events where taken into consideration: Easter = 1, Christmas = 2 and St. Valentines = 3);

- PRET and PRET_UM describes the price at which the product was purchased by the company and the currency.

The fields that describe the dimensions of the product are not mandatory. For this simulation only 14 products were inserted manually in the table: tomatoes, cucumbers, salad, apples, lemons, oranges, quince, toilet paper, paper napkins, wet wipes, oil, vinegar, tree lights and eggs. They can be grouped in 4 categories. Tree lights are specific to Christmas, and eggs to Easter, so they have code 1 and 2 for field ZI_SPECIALA. The rest of the products have code 0 for this field, which mean no special event.

Table ZCSD_PROD_COMPL contains only 3 fields:

- MANDT which is mandatory;
- ID_PRODUS which is the code of the product that have complementary products;
- ID_PROD_COMPL the complementary products.

All 3 fields are part of the key of the table. Looking at the 14 products that the company have, there can be defined a complementary only between the vegetables (tomatoes, cucumbers and salad) and oil and vinegar (these are salad seasoning). So there are only 6 records in this table.

Table ZCS_BONURI_FISC contains 10 fields

- MANDT which is mandatory;
- NR_BF uniquely identifies the bill (all companies must keep track of them);
- NR_PROD number of the product from the bill;
- ID_CLIENT the client who bought the product;
- ID_PRODUS the product bought;
- CANTITATE and CANT_UM the quantity bought and it's unit of measure;
- PRET and PRET_UM the price and it's unit of measure;
- DATA the date when the product was bought by the client.

All fields from this table play an important role in the simulation of the algorithm. The data is used in order to determine the eligibility of the client, while the products included in the bill are used to determine what other products can be proposed to the client. For the simulation 10 bills are added. Only 5 from the 6 clients bought products from the company (client 1239 didn't buy anything), while most purchases were made by client 1234. A selection screen is created for the simulation program and contains two blocks. First block is entitled "Clients for which offers are created" and contains 3 parameters:

- the id of client (if this select-option is left blank, than the program selects all clients);
- number of products included in the offer (for this simulation the number is set at 4, one for each category); this is only an output field, because it is unlikely to be changed often;
- unit of time (for this simulation the number is set at 28 days); this is also an output field, because it is also unlikely to be changed often.

Source: SAP output (author's creation)

Figure 9. Personalized offer for Mircea Popa

Second block contains 2 parameters: a check box which by default it is left blank (if the box is checked than the program runs for a special day, and in this case a code must be selected), and the code for the special day (for this simulation I considered the value 1, which mean Christmas). Only the clients that have the ID code between 132 and 134 will be selected. The selection screen can be extended and other parameters can be added, according to the complexity of the algorithm, and the accuracy of the results. According to the algorithm only client with ID 132 is eligible for proposing him an offer. If the eligible client is selected and the custom button ("Genereaza oferte pentru clienti") is pressed than the personalized offer will be generated (figure 10). The offer includes the name of the customer in the title (*Only for you Mircea Popa…*) and is available after 7 days of the last shopping event.

The discount is directly proportional with the shopping frequency of the client (the client went 4 times to the supermarket in the last 28 days, so the discount is 4% - other rules can also be implemented in order to determine the discount). The personalized offer contains 4 products: day product specific (eggs – the special day is Easter as the code introduced on the selection screen is 1), product previously purchased (salad), complementary product (pasta) and the product different from shopping cart (tomatoes), mentioning for each of the products the old price and the price obtained by applying the discount. The barcode is a unique identifier for the products reduced for a specific customer, which is easily scanned by the cashier when the products are purchased and discounts are automatically applied by the system. The code is a unique combination between the customer unique identification, product identification code, discount and the period during which the discount applies.

Conclusion

Due to the exponential growth of population and the rapid evolution of technology, consumers needs have become in the last century very diverse. Given this radical change of the economic environment in which the bargaining power has shifted from sellers to buyers, companies had to adapt, and thus, had to modify their marketing strategies. In this respect, companies began to realize that keeping existing customers is less expensive than gaining new ones and that satisfaction of actual consumers may cause their failure or their success. So, more and more companies have begun to use the newest technologies to increase customer satisfaction. Considering these changes, I developed a model to predict the consumer behaviour.

The purpose of the algorithm is to increase the profitability of companies by creating personalized offers for each customer. The algorithm can be applied to any company, regardless its field of activity, and it can be customized depending on the characteristics of each company. In order to implement and simulate the algorithm I used the SAP software, one of the most complex and used ERP software. The application identifies the clients eligible to receive personalized offers (the eligibility is determined according to the shopping frequency) and the products that can be included in the offer (the products can be day specific, already previously purchased by the consumer, complementary to the previously purchased products or different from the shopping cart). Through these offers, the companies can gain the loyalty of actual clients for a longer period of time, and as result, their sales may increase. Therefore, companies should include these algorithms in their marketing strategies to increase customer satisfaction and also to increase their profitability. The program that I developed takes into account only some characteristics such as company specific unit of time (in the simulation is set to 28 days) and the maximum number of items that can be included in the offer (in the simulation is set to 4 products). Therefore, in the future, I will make more complex simulations by diversifying the database and by adding new variables in the model such as different characteristics of clients (sex, age, income). Thus, by combining psychology, economics and computer science, findings on consumer behavior are becoming increasingly accurate. As an open point, the model can be tested in a supermarket in order to demonstrate its utility and after that a specific module for consumer behaviour and client satisfaction can be created in the SAP program.

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