ATLANTIS PRESS
Advances in Economics, Business and Management Research, volume 95
6th International Conference on Strategies, Models and Technologies of Economic Systems Management (SMTESM 2019)

Model for Consumers Priorities Detection in E-trade Based on Classifying a Client's Personal and Consumer Profile

Oleg Pursky
department of computer science
Kyiv national university of trade and economics
Kyiv, Ukraine
e-mail: Pursky_O@ukr.net

Oleksander Kharchenko
department of software engineering and cyber security
Kyiv national university of trade and economics
Kyiv, Ukraine
e-mail: a.kharchenko@knute.edu.ua

Olena Fomina
department of accounting and taxation
Kyiv national university of trade and economics
Kyiv, Ukraine
e-mail: fevfin@gmail.com

Daria Holovina
department of accounting and taxation
Kyiv national university of trade and economics
Kyiv, Ukraine
e-mail: dvkarpenko88@gmail.com

***Abstract*— In this work we present the developed model for consumers priorities detection in e-trade based on classifying a client's personal and consumer profile. The presented model allows to improve the business process of choosing a rational set of goods and services depending on customer characteristics, to ensure the rationality and timeliness of receipt of goods and services on the e-trade market and ensure their diversification and differentiation. A rational set of information parameters about clients and their activity on the e-trade market has been proposed. The process of collecting, preparing and analyzing information about market clients for its subsequent clustering and classification has been described. The sources of information and connection between the selected consumers characteristics have been revealed (consumers characteristics of the e-trade market have been illustrated). The notion of a consumer profile in the e-trade market and client profile as a descriptive element of an element in the middle of the client cluster have been described. If the consumer profile and a set of personality characteristics of the cluster kernel or its element change, the set of goods and services changes accordingly. Taken together, they reflect the integral model of a typical e-trade client and can be used to identify and analyze customer priorities.**

Keywords—e-trade, consumers characteristics, classification, personal profile, consumer profile.

I. INTRODUCTION

Modern economy is often called the economy of services; this fact is explained by the fact that the scope of services is more than 50% of the GDP of most developed countries in the world [1]. Every year, the scale of consumption and the range of services are growing, which involves the presence of a large volume of information flows, which enterprises can not effectively handle without the introduction and subsequent use of modern software tools, on the basis of intelligent methods and specific business software decisions.

E-commerce, as compared to traditional business, has substantial advantages. In particular, the use of new electronic communication channels significantly reduces costs related to organization and support business infrastructure, and the possibilities of e-commerce allow re-designing business strategy at any moment [2]. The development of a civilized e-trade market is primarily due to increased competition. Manufacturers of goods and service providers of high-tech industries (telecommunications, "cloud service" providers, etc.) are trying to offer new solutions to consumers' problems. It provides consumers with the right to choose and forms a variety of products and services, and as a consequence, stabilizes the progressive development of the e-trade system.

The most effective CRM strategy in e-trade will be to build long-term trust relationships with all existing and potential clients (each with them) so that they know about the opportunities and competitive advantages of business products and services and could at the right time use them without unnecessary costs and efforts managers' side. Obviously, there are branches of the economy in which the construction of such relations with each of the clients is virtually impossible - there are many customers, the size of the profits from each one is small and keep the information about each of them economically unprofitable. Information on consumer goods and food products is easier to convey to millions of consumers through the media through template promotional offers, since the cost of delivering information to each buyer on such products is clearly higher than the profit from their purchase by a particular buyer. In the area of work with private clients, the possibility of building personalized relationships is also becoming a key competitive advantage, part of the psychology of e-business. The consumer is more than happy to take his money to a bank where he has a familiar bank employee or buy a car where he has a contact with the sales manager who would explain to him honestly and frankly the advantages and disadvantages of each of the cases of purchase and offered the optimal price conditions. First of all, it concerns expensive purchases (transport, real estate, furniture, rest, etc.), but the factor of personalized relationships with customers, gradually moves into the sphere of more mass

purchases (communication, entertainment, service life). Proceeding from the methodology of the relationship "consumer-supplier", all the above mentioned, equally relevant for the e-trade market. At the same time, due to the high market dynamics and a considerable increase in the number of interaction actors, in addition to the main channels of interaction between suppliers and consumers of electronic trade, there is a need for an operational feedback channel. The feedback is organized through the introduction of an intelligent information systems of decision support. Their implementation allows the consumer to maximally influence the market offers, and for supplier to offer, in the automatic mode, the most rational and customer oriented products and services, oriented not only to the overall dynamics of consumption of goods and services in the e-trade market, but also the dynamics of services consumption by individual customers and client groups (clusters) for the objective detection of emerging on the market of client preferences.

Typical e-trade companies in their operation mechanisms contain a large number of different business processes, and about 70% of them require operational solutions, for example, in processes such as purchase / sale procedures or service formalization. Such operational decisions may also include the question: "whether the service is rational for this group of consumers," or "if the set of services for the client in terms of its solvency and profile of its domestic consumption rational" etc. Together, these business decisions represent an important factor in the e-trade company's success - the implementation of corporate policies, ensuring maneuverability, operational responses to changes in business compared with competitors and partners in the e-trade market. In addition, the e-trade market is dynamic and is regularly replenished with new goods and services: services for individuals, small businesses, affiliate programs for corporate clients, VIP clients and other legal entities that contain a large number of conditions and offers within each clients category. There is a logical problem of choosing a specific product and service for a particular customer profile in the e-trade market, which is determined by a set of consumer priorities [3].

Thus, the policy of the average package of services for the faceless mass of clients becomes ineffective in maintaining or, moreover, maximizing income from one consumer (with a minimization of costs). The department of service management of the company has to face new conditions of functioning, competition in the struggle for consumer commitment. The cost of delivery of goods is constantly changing, the demand for new innovative services is growing, the composition and conditions of services provision in electronic commerce are constantly changing. In addition to searchung the claimed goods and more rational services for the customer group (from the point of view of the consumer and service provider), all changes must be made to the position, instructions, business processes, and then to the information systems.

Therefore, for e-trade companies, the problem of forming client profiles with the corresponding sets of consumer preferences, comes first in its relevance, and they begin to rethink their strategies in the field of information technology and systems, to seek new approaches for responding quickly to external and internal changes, from using adaptive models and modern information technologies.

II. MODEL

In the field of work with clients, the possibility of building personalized relationships is also becoming a key competitive advantage, part of the psychology of e-business [4], [5]. For industries in which competition has reached the level of interaction with each client, establishing and maintaining relations with it becomes a key, if not the main competitive advantage. First of all, it concerns the provision of services, where each client is a complex system of internal relations with constantly changing requirements. Awareness of these requirements, the ability to establish relationships with the organization as a whole and with decision makers, is now a prerequisite for effective e-business. The ignorance of these current needs, the inability to find a personalized approach to solving their problems leads to the fact that customers are moving towards a more flexible and loyal competitor. In order to successfully compete with other e-trade companies, it is important to know their consumers well and to have a complete picture of the wishes and needs of current and potential clients, to study and analyze the market for goods services.

To implement this strategy, it is necessary to divide a set of clients into classes , each of which will correspond to a unique customer class for this class consumption [6]. It is necessary to study and understand the needs of existing classes of customers with their subsequent analysis and the creation of a fundamentally new strategy for retaining and attracting new customers. The process of distributing clients to homogeneous groups based on aggregated attributes for each class (habits, tastes, dynamics of goods and services consumption) should become part of the strategy and methodology for promoting the company's goods and services in the e-trade market.

The term "customer clustering" means the process of classifying clients into homogeneous groups based on common attributes (habits, tastes, consumption dynamics, etc.). "Customer personal profile" describes the client for his or her personal attributes, such as age, gender, income and lifestyle. "Customer consumption profile" - the partial or percentage consumption of goods and services in the middle of the client cluster, can also be measured in absolute terms. With these two profiles, marketers can decide on marketing actions for each cluster of clients, and then allocate resources between clusters in order to address specific business processes. In order to find the balance between the supplier and the consumer of goods and services, customers satisfaction, automation of selection of goods and services by the customer depending on the dynamics of consumption and sociodemographic characteristics, the following model of the implementation of the process of the consumers priorities detection within the framework of implementation the business process of a rational set of goods and services selection in the context of customer characteristics has been offered (Fig. 1). The supplier of goods and services in e-trade develops special service sets based on consumption profiles of client cluster elements and their centers. Each element of the cluster of consumers in the e-trade market is determined by one of the specially created service kits *n* (formed from templates). If the consumption profile of the cluster element changes, the set of services changes, which determines the two-way communication of information flows in the model (Fig. 1).

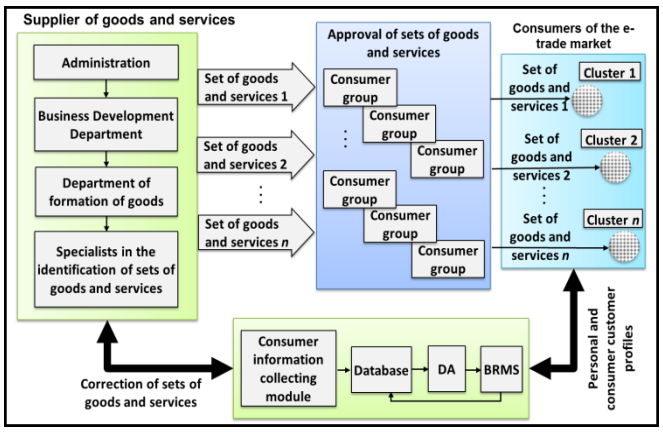

Fig. 1. Model of realization the process of consumers priorities detection in the framework of cooperation between seller and buyer using clustering and classification on the basis of personal and consumer profile of client

The study considers issues of clients clustering without the use of knowledge of experts and without pre-classification. Clustering is carried out on the basis of data on goods and services consumption for the period of time (month) and additional information on consumers [7] - [9] on a random sample basis for 1000 clients from 5000 clients of the studied aggregate of consumers. In order to achieve this goal, a method for detecting client preferences has been developed.

III. Customer Characteristics System

The most important factor in the process of data analysis (DA) is understanding of the data and their interconnections. In order to obtain an adequate and qualitatively correct description of the client, the choice of variables (characteristics) [10] is crucial. To determine the characteristics, it is necessary to select the smallest set of variables that fully describe the behavior of the buyer. The following keywords can help in defining the characteristics:

- How?: How does a customer facilitate the creation of a record of data on the purchase of goods? Does he make a voice order on the phone, make an order through the website of the online store or use for this his e-mail?
- Whom?: Whom does the customer make an order to? List of potentially interesting online stores for the buyer.
- What?: What type of goods (types of goods) is interesting to the buyer?
- Where?: Where are the customer and the online store? Can he make international orders for goods and services?
- When?: When does a customer make an order? The client can make calls during the working time or during non-working hours in the evening, at night or on the weekend.
- Where?: Where does the customer order delivery? Can he order delivery to another country?
- How long?: How long does the order last?
- How often? How often does a customer make and confirm an order?

Using these keywords and criteria that are offered in literary sources [11], [12], we can build a list of characteristics that can be used as a brief description of the client's consumption of the Internet store services (in relative and absolute terms):

a) *Order mechanisms:*

- Order in your (home) region (average volume of orders per unit time).
- Order through the website of the online store (average volume of orders per unit time).
- Order through fixed telephones (average volume of orders per unit time).
- Orders via mobile phones (average volume of orders per unit time).
- Orders via e-mail.
- Orders in other regions of Ukraine (average volume of orders per unit time).
- International orders (average volume of orders per unit time).

b) *Income-generating services:*

- Volume of orders (total per unit time).
- Volume of orders on order channels (the total amount for each individual channel per unit time).
- Volume of orders by delivery type (total volume for each individual type per unit time).
- Volumes of orders at the place of delivery (total volume for each separate type of place of delivery per unit time).
- Volumes of orders by type of goods (total volume for each separate type of goods per unit time).
- Volume of orders for specific online stores (the total volume for each individual online store).
- Volumes of orders by type of payment (total volume for each separate type of payment).
- Duration of the order (average duration of one order in units of time for a certain period).
- Number of orders (average quantity per unit time).
- Orders on working days (measured in percentages).
- Orders in daylight hours, from 9:00 to 18:00. (measured in percentages).
- Completed purchases (measured in percentages).
- Relationship between completed and incompleted purchases.
- The ratio between orders in the daytime and overnight and in working days and non-working days of the week.

- The relationship between purchases (completed orders) in the daytime and overnight and in working days and non-working days of the week.

Most of the 22 characteristics listed above can be generated directly from the source data obtained from the data store of a specific online store, but some features require a creative approach and certain actions with data. For example, customers who use the phone only in the workplace and clients who also use the phone for personal purposes may be in different clusters. In this case, clustering is based on the percentage of calls in weekdays and in daylight hours. It is clear that the generation of useful characteristics, including aggregated characteristics, is an important factor in the process of data mining. If the wrong characteristics are generated, the data mining will fail. Although the choice of characteristics needs to be guided by logically correct conclusions, it is also necessary to use a research data analysis. In addition, for each aggregated feature, there should be a variance of data; otherwise, the difference between the clients will be absent, and the function will be unnecessary. On the other hand, too wide variance significantly complicates the process of clustering.

The selected characteristics are not accidental, they have been carefully selected and serve as an information base for client clustering and classification procedures. Customer profiles are the basis for establishing effective relationships with existing customers in order to maintain customers, provide them with better quality services and attract new customers. Creating customer profiles is done by synthesising the collected information about clients, including demographic and personal data. Custom client profiles can also be used to find new clients using custom interaction mechanisms typical for a given customer profile, for example, based on demographic data received from different sources. These data are used to connect with client clusters that are formed in the original stage. This allows to create a corresponding cluster (for e-trade services) and vice versa for each client's profile (representing a combination of demographic and personal data only for this profile). For each profile, an assessment can be made of the behavior of customers using e-trade tools and mechanisms when making an order and purchasing a product. Depending on the specific purpose, it is necessary to select profiles that are directly related to the project. A custom client profile is a file that contains at least age and gender information. If customer profiles are required for specific goods and services, the file will contain information about the product (service) and / or the amount of funds spent. Customers' characteristics that can be used to create profiles, have been considered in the works [13]:

- Geographic information. Are the grouped clients at the regional, national, or global level?
- Cultural and ethnic characteristics. What language do customers speak? Does ethnic influence the customer's preferences or their behavior when purchasing goods?
- Economic conditions, income and / or purchasing power. What is the average revenue or customer purchasing power? Do they have any difficulty with payment? How much money and how often does the client spend on each product?
- Age and sex. Which age group is predominant among your target customers? How many children are in the family and what age are they? Among customers using a particular product or service, are women or men predominant?
- Values, views and beliefs. What is the customer relationship with your product or service?
- Life cycle. How regularly does the customer buy your products and use your services?
- Knowledge and understanding. What knowledge do customers have about products, services, or industry? What is the level of education required? What brand advertising is required, so that customers are aware of e-trade offerings?
- Lifestyle. How much are the useful characteristics of lifestyle buyers?
- The method of attracting a client. How was the involvement of the client?

The choice of characteristics also depends on the availability of customer data. With these characteristics, a customer assessment model (customer profile) can be created. Clients of the e-trade company can be divided into corporate and private. In turn, we will divide clients into two main profiles: progressive and conservative. Progressive consumption profile is characterized by high consumption of goods and services in the e-commerce market. Conservative consumption profile is characterized by moderate and low consumption of goods and services in the ecommerce market. Also, in addition to profiles, it is necessary to allocate a "golden mean" - users who consume a moderate amount of goods and services in the ecommerce market. In addition, according to customer profiles, their expenses for goods and services are also shared. Corporate clients are divided into four groups, depending on the size of the company and the number of employees: small, medium, large businesses and corporations. The corporation bill for the consumed services is issued to a legal entity.

Most often, when it comes to personal, confidential data, they are inaccessible in full. There is no information on lifestyle and customer income. However, using a creative approach one can find some information in the database of the e-trade company [7] - [9]. The information contained in the database contains the name and address, as well as other information, such as the service plan, contract information and telephone number. With these data, you can use the following metrics to create customer profiles:

- Age group: "<25, 25-40, 40-55, > 55 years old".
- Gender: male, female.
- Phone type: mobile, fixed.
- Private client type: conservative, moderate, progressive.
- The size of the corporate client: small, medium, large, corporation (data on the individual contact person).
- Place of residence: a big city, a small city.

Since a relatively small difference in customer age may mean similar consumer behavior, clients should be grouped by age. Otherwise, the result of the classification algorithm is too specific for the knowledge base formation [14]. The primary goal of grouping metrics is to reduce their number to a managed number and eliminate correlations between metrics. The composition of the groups should be chosen with particular care. It is extremely important that the size of the groups, if possible, are practically equal [15]. If there are groups, the number of clients in which will exceed the number of clients in other groups, this will lead to a decrease in the efficiency of the classification. This fact is linked with the issue that this group presents a relatively large number of clients from each cluster. Therefore, based on this characteristic, it will not be possible to determine the cluster of the client. Table 1 presents the results of the analysis of the investigated clients (the entirety, in percent) in the selected group according to the chosen indicators. Table 1 clearly shows that group sizes are well-matched, and the values obtained can be used to create customer profiles. estimate customer clusters, the method of support vectors machine using customer profiles is used.

TABLE I. PERCENTAGE RATIOS OF DIFFERENT CLASSIFICATION GROUPS

GROUPS	**PERCENTAGE RATIOS**			
Age group	<25 26,22%	25-40 34,5%	40-55 27,9%	>55 11,4%
Gender	Men 60,2%	Women 39,8%		
Phone type	Mobile 73,4%	Landline 26,6%		
Private clients type	Conservative 34,9%	Medium 36,0%	Progressive 29,1%	
Corporate client size	Corporation 16,9%	Large 17,2%	Middle 34,4%	Small 31,5%
Place of living	Big city 42,0%	Town 38,0%		

IV. CONCLUSIONS

Consumer behavior of the subjects of the contemporary e-trade market depends more on the availability of an effective strategy of long-term trust relationships with each of existing and potential clients, that providing them with the opportunity to receive timely information about the competitive advantages of the offered products and services and their timely use without unnecessary expenses and efforts, both from the side of clients, and from the department of e-trade enterprise services management. There is a logical problem of choosing a specific service for a particular client, or client cluster among market diversity. The developed model of consumers priorities detection in e-trade allows to improve the business process of choosing a rational set of goods and services depending on customer characteristics, to form an actual system of market relations and to ensure the rationality and timeliness of receipt of goods and services. In this regard, the general concept of effective interaction between the sellers and buyers in e-trade can be formulated as follows. A seller in e-trade has to develop special service packages based on the characteristics of the consumer profile inside the cluster and the set of social and demographic characteristics of the client. Each element of consumer cluster in the e-trade market is brought into line with one of the specially created sets of goods and services from the total number of sets. If the consumer profile and a set of personality characteristics change, the set of goods and services changes accordingly. Application of the presented model for identifying customers priorities contributes to implementation of the above mentioned concept of relationships between sellers and buyers in e-trade.

ACKNOWLEDGEMENT

This study was supported by the Ukrainian Ministry of Education and Science, Project No. 0117U000507, “Modeling the mechanisms of international e-commerce operation”.

REFERENCES

[1] M. McDonald, and H. Wilson, *Marketing Plans: How to Prepare Them, How to Use Them*, 7th ed. Oxford: John Wiley & Sons, 2011.

[2] O.I. Pursky, B.V. Grynyuk, and D.A. Shestopal, “Planning of advertising costs and vendor number at e-trade market”, *Actual Problems of Economics*, vol. 177, no. 3, pp. 407-413, 2016.

[3] D. Kahneman, “Maps of bounded rationality: psychology for behavioral economics”, *The American Economic Review*, vol. 93, no. 5, pp. 1449-1475, 2003.

[4] H. Ansoff, *Strategic Management*, Heidelberg: Springer, 2016.

[5] A.B. Atkinson, and J.E. Stiglitz, *Lectures on Public Economics*, Revised ed. New Jersey: Princeton University Press, 2015.

[6] R. Sankar, “Customer data clustering using data mining technique”, *International Journal of Database Management Systems*, vol.3, no.4, pp. 1-11, 2011.

[7] Electronic trade company Rosetka. [Online]. Available: https://rozetka.com.ua. Accessed on: July 5, 2019.

[8] Official site of the e-trade company Mobilluck. [Online]. Available: http://www.mobilluck.com.ua/mob_cont.php. Accessed on: July 5, 2019.

[9] Online store 27.ua. [Online]. Available: https://27.ua. Accessed on: July 5, 2019.

[10] M. McDonald, and I. Dumbar, *Market Segmentation: How to do it, How to Profit from it*, 3rd ed. Oxford: Butterworth-Heinemann, 2004.

[11] V. Jadczakova, “Review of segmentation process in consumer markets”, *Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensi*, vol. LXI, no.4, pp. 1215-1224, 2013.

[12] J. Ahola, and E. Rinta-Runsala, “Data mining case studies in customer profiling”. Research report TTE1-2001-29. [Online]. Available: https://www.vtt.fi/inf/julkaisut/muut/2001/dm_case_studies.pdf. Accessed on: July 5, 2019.

[13] J.-L. Amat, “Using reporting and data mining techniques to improve knowledge of subscribers; applications to customer profiling and fraud management”, *J. Telecom. Inform. Technol*., vol. 3, no.3, pp. 11-16, 2002.

[14] R. Mellor, *Knowledge Management and Information Systems: Strategies for Growing Organizations*, London: Palgrave, 2011.

[15] D.R. Cox, and C.A. Donnelly, *Principles of Applied Statistics*, Cambridge: Cambridge University Press, 2011.