

Managing the Competitiveness of the Enterprise in the Context of Transformational Change



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Abstract: Most enterprises currently regard customer loyalty as the primary tool for increasing their competitiveness (from among non-price methods). To test the theoretical results of the study, a dynamic client base management model was developed for a enterprise in the real sector of the economy, and on the basis of this model, a strategy was found to optimally manage the enterprise's client base over an interval of 12 months, which would maximize the long-term cost of the client base. The control effect found using the gradient descent method, along with optimization of the company's expenses and improvement of the customer base's efficiency, will simultaneously allow you to control not individual clients, but groups of clients of the enterprise in accordance with the model developed in this study, adapted for groups of clients; to take into account differences in the customer behavior of customers and to track changes in the quality characteristics of the customer base. All this allows to increase the competitiveness of the enterprise significantly.

Index Terms: competitiveness, customer, enterprise, loyalty, transformational change.

I. INTRODUCTION

Competitiveness is commonly understood as the real and potential possibilities of commercial enterprises in the conditions existing for them to design, manufacture and market products that are more attractive to the consumer than their competitors in price and non-price characteristics. Following this interpretation, the company's competitiveness can be defined as maintaining the values of the strategic indicators of its activities in a state of sustainability, ensuring the economic efficiency of the business at a level acceptable to owners [1-2].

Such strategic indicators can be: financial stability and solvency, a functioning agent network [3], the market share held [4], etc.

The specific set of targets depends on the mission declared

by the company and its strategic objectives. To create a sustainable competitive advantage, any commercial enterprise should identify the principal competitive factors for its business area from among:

- macro-factors, among which stand out state regulation, the general political and economic situation, active social processes, etc.;

- microfactors, which include competitors, investors, suppliers, intermediaries, contact audiences.

The determination of the level of competitiveness of an enterprise is influenced by its components, which include:

- the quality of the product offer (the quality of the goods themselves and the assortment offer, including completeness, breadth and depth, stability and balance of the range) [5-7];

- quality of service activities (service process) [8-10].

II. CUSTOMER LOYALTY AS A FACTOR IN ENTERPRISE COMPETITIVENESS: MANAGEMENT

Most enterprises currently regard customer loyalty as the main tool for increasing their competitiveness (from among non-price methods). Thus, according to experts, a low level of reliability in a business environment reduces the efficiency of economic activity by 25–50%, and sometimes more. The growth of regular consumers by 5% leads to a 25–100% increase in profits. In most industries, the profit from each client grows as its cooperation with the company increases. At the same time, as a rule, to compensate for the losses from one departed old client, it is necessary to attract several new ones. Thus, according to the generally accepted definition, loyal customers are those who positively relate to the company's activities, its products and services, its staff, etc. This positive attitude is expressed by the preference given to the products of this company in comparison with competitors, and this preference is stable in time and is characterized by making repeated purchases.

The consumer follows the re-purchase scheme, because it is this brand that satisfies his needs well, or because his personal brand loyalty is formed.

Given the rational component in the behaviour of customers, there are three types of loyalty:

1. Commitment.

Loyalty associated with an attitude is manifested as consumer interest in purchasing from this company, implies emotional involvement and affection of the consumer to the company, complete satisfaction with the relationship with this organization, interaction with the company for an unlimited time. The consumer highly appreciates the company, is satisfied with the cooperation with it,

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has an interest in it and emotional affection, but does not have the opportunity to often buy in this organization (economic factors or the company's absence on the market). When such an occasion arises, he acquires it from her.

2. Behavioural loyalty

Behavioural loyalty is manifested when making purchases in the company on an ongoing basis but in the absence of attachment.

The consumer is either not satisfied with the cooperation with the company in which he buys the product/service, or treats it with indifference. Despite this, the consumer is forced to interact with this company due to the lack of a "favourite" brand on the market or for economic reasons. At the first opportunity, the consumer goes to the company to which he is experiencing emotional attachment. There are cases when the consumer has no brands to which he feels affection at all.

3. Mixed type

The consumer regularly makes purchases from this organization and experiences with this emotional affection and deep satisfaction. Thus, in this case, we can talk about a combination of commitment and loyalty. Summarizing the above, we can conclude that loyalty is an indicator that characterizes the attitude of the client to the company, to the goods/services provided by it. It includes both emotional and rational component. The degree of loyalty is reflected in the customer behaviour of the client, his intention to continue his relationship with the company and willingness to cooperate with it.

III. SETTING THE TASK OF MANAGING THE COMPANY'S CLIENT BASE

The formulation of the mission of managing the company's client base is based on the following underlying assumptions.

Assumption 1. All clients of the company can be divided into K non-intersecting clusters depending on the frequency of purchases, the size of the average check and the socio-demographic situation.

Assumption 2. Moving customers between different clusters in the event of an undetected influence of the history of the relationship between the client and the company can be described using an adapted model of personnel movement

Assumption 3. Customer value for the company can be estimated using the frequency of shopping and the size of the average check.

Assumption 4. The costs incurred by the company in managing the customer base can be divided into two categories: expenses for attracting new customers and costs for retaining existing customers and increasing their loyalty.

Assumption 5. Changes in customer buying behaviour: the intensity of the transition between clusters, the frequency of purchases and the size of the average check, is influenced by the following factors:

- external market impact;
- the internal effect of the company's marketing activities;
- changes in customers' own needs, regardless of the outside world.

The criterion for the optimal management of the client base is the maximization of the long-term cost indicator (CLV) of the company's client base over the time interval T.

The client base management tools are marketing activities

that are aimed at stimulating and changing the purchasing behaviour of customer groups to increase their profitability over the long term.

The budgetary constraint B for conducting marketing activities for each point in time t serves as the boundary conditions.

IV. METHODOLOGY

A. Mathematical record of the client base management problem

Thus, the mathematical notation of the client base management problem can be formulated as the following system of equations:

$$\begin{cases} \sum_{t=1}^T \frac{1}{v_t} \left(\sum_{i=1}^K N_i^t F_i^t M_i^t - \sum_{l=1}^L z(Ad_l^t) \right) \rightarrow \\ \sum_{l=1}^L z(Ad_l^t) \leq B^t, t \in [1, T] \end{cases} \quad (1)$$

where N_i^t is the number of cluster i at the moment of time t, calculated by the formula (2);

$$N_i^t = (1 + a_{ii}^t) N_i^{t-1} + \sum_{j=1}^K a_{ji}^t \cdot N_j^{t-1} - \sum_{j=1}^K a_{ij}^t \cdot N_i^{t-1} + (c_{2i}^t - c_{1i}^t) \quad (2)$$

F_i^t is the average frequency of purchases for cluster i at time t, calculated by the formula:

$$F_i^t = f_i(Ad_1^t; \dots Ad_L^t) \quad (3)$$

f_i is a function reflecting the dependence of the frequency of purchases of cluster i on the company's marketing activities;

M_i^t – the average check in cluster i at time t, is calculated by the formula:

$$M_i^t = m_i(Ad_1^t; \dots Ad_L^t) \quad (4)$$

m_i – a function that reflects the dependence of the average check of cluster i on the company's marketing activities;

Ad_l^t – a factor characterizing a set of marketing activities with specific parameters: type of marketing event, product category, region, amount of discount/bonus points, at time t;

$z(Ad_l^t)$ – the cost of the factor Ad_l^t at time t;

B^t – the size of the budget for marketing activities at time t;

K – the number of client base clusters;

v_t – discount factor at time t.

B. The solution of the optimal control problem

The answer to this optimal control problem is such a set of marketing activities $Ad_1^t; \dots Ad_L^t$ at each moment of time $t \in [1, T]$, at which the maximum long-term value of the customer base is reached.

The reduced gradient method (RGM) is based on reducing the dimension of the problem using the representation of all variables through a set of independent variables.

He was first proposed by Wulf in 1963[11] for linear programming problems with linear constraints. Gradient descent is a method of finding a local extremum (minimum or maximum) of a function by moving along a gradient. To minimize the function in the direction of the gradient, one-dimensional optimization methods are used; for example, the golden section method.

Later this method was generalized to the case of nonlinear constraints. The generalized reduced gradient method is used to search for the minimum of an objective function on a set given by nonlinear constraints, such as equality and inequality. The technique can be used even in the case of non-linear functions, limited both from above and below.

The advantages of this method are:

- the simplicity of the formulation of the objective function as a function of independent and dependent variables;
- the possibility of obtaining a feasible solution at each iteration due to changes in the places of dependent and independent variables;
- the stability of the algorithm to the violation of the initial premises and its reliability;
- optimal solutions are found even with large intervals setting the initial conditions.

C. Initial data for analysis

Initial data for analysis (list of used variables):

1. Unique identifier of the client (Client_ID).
2. Sex (Sex). Accepts values: 1 - man, 0 - woman.
3. Age (Age).
4. Marital status (Family_Status). Accepts values: 1 - married / married, 2 - single / not married, 0 - not specified.
5. Date and time of purchase (Purchase_Date).
6. Purchase amount in RF rubles (Purchase_Sum).
7. The category to which the purchased product belongs (Purchase_Category). Accepts the values: 1 - cell phones, smartphones; 2 - photo and video equipment; 3 - laptops, netbooks, tablets; 4 - accessories; 5 - payments; 6 - financial products (money transfers, loan repayments, insurance products); 7 - non-core goods; 8 - used goods; 9 - tariff plans, services of mobile operators.

Data on the set of parameters is presented for each unique client of the company, i.e. represent panel data. To analyze consumer behaviour in dynamics, it is necessary to make a transition to time series, i.e. to the indicators characterizing the customer's buying behaviour at each of the specified planning intervals – a month.

To solve this problem, the following *aggregation variables* were calculated in the work:

1. Date of the first customer purchase (First_Purchase_Date).
2. Date of the last customer purchase (Last_Purchase_Date).
3. The number of customer purchases: a. for the entire period (Purch_Num_All); b. Monthly (Purch_Num_i); c. monthly cumulative total (i Purch_Cumu I_Num).
4. The amount of customer purchases: a. for the entire period (Purch_Sum_All); b. Monthly (Purch_Sum i); c. Monthly cumulative total (i Purch_Cumu I_Sum).
5. The frequency of customer purchases: a. for the entire period (Freq_All); b. Monthly cumulative total (Freq_t). The frequency of purchases at time t is calculated as the ratio of

the number of customer purchases made at time t to the number of months elapsed from the date of the first purchase to time t.

$$Freq_t = \frac{\sum_{i=1}^t Purch_Num_i}{t} \quad (5)$$

where:

$Freq_t$ is the frequency of customer purchases at time t;

$Purch_Num_i$ – the number of purchases made by customers in the month i;

t – the number of months elapsed from the moment of the first purchase to the moment of the indicator calculation.

Note: the frequency of purchases in the last month coincides with the frequency of purchases in the calculation for the entire period of time.

6. Customer Average Check: a. for the entire period (Avg_All); b. Monthly cumulative total (Avg_t). The average customer check at time t is calculated as the ratio of the aggregate amount of customer purchases at time t to the number of customer purchases at time t.

$$Avg_t = \frac{\sum_{i=1}^t Purch_Sum_i}{\sum_{i=1}^t Purch_Num_i} \quad (6)$$

where: Avg_t is the average customer's receipt at time t;

$Purch_Sum_i$ – the number of purchases made by the client in the month i;

$Purch_Num_i$ – the number of purchases made by the client in the month i;

t is the number of months elapsed from the moment of the first purchase to the moment of the indicator calculation. 7. The number of months passed from the beginning to the last purchase.

8. The number of months elapsed from the first purchase to the disposal of the client or to 2019, if the client is active.

9. The number of months passed from the last purchase to the destruction of the client or until 2019, if the client is active.

D. Used data analysis packages

The following data analysis software tools were used:

- IBM SPSS Statistics, version 25;
- Eviews 10 Standart Edition;
- Microsoft Office Professional Excel 2016.

V. APPROBATION

For the clustering of the client base, the normalized values of the following sets of variables were used:

1. Frequency of client purchases (for the entire period).
2. Average customer check (for the whole period).
3. The number of months from the first purchase to the retirement of the client or until 2019, if the client is active1. In the future, this indicator is referred to as the client's "life" time.
4. The number of months from the last purchase to the disposal of the client or until 2019, if the client is active.



In the future, this indicator is referred to as the client's "sleep time".

The client base was clustered using the k-means method using the IBM SPSS Statistica software toolkit. As clustering parameters, the division into 3, 5, 7, and 10 clusters were sequentially selected. As a result of the analysis of clustering results, a further 5 cluster solution was selected for new research (Table 1).

Table 1. Clustering client base (5 clusters)

Parameter	Cluster 1	Cluster 2	Cluster3	Cluster4	Cluster 5
Average bill	1240.5	634.6	15480.2	850.6	1825.7
"Life" time	29.5	26.4	22.1	23.5	42.8
"Sleep" time	8.6	43.2	15.8	1.4	38.6
Frequency of purchases	0.3	3.5	0.5	8.6	0.1
Cluster size	60582	12580	3580	1205	38569

Clients with zero repeat purchases were excluded from the client base clustering procedure. The total number of such clients is 82360 of which: • having made only 1 purchase – 45802 people; • made more than 1 purchase, but within one day – 36558 people.

The values of the average check, lifetime and sleep time for a cluster of customers without repeated purchases are presented in the table (Table 2).

Table 2. Purchasing behaviour indicators for a cluster without repeated purchases

Parameter	Minimum	Maximum	Average	Std deviation
Average bill	10.2	127850.0	3201.2	4305.6
"Life" time	1	63	32.5	14.5
"Sleep" time	0	61	31.4	14.5

To identify differences like consumer behaviour of selected clusters or socio-demographic differences, a visual analysis of the data was conducted and histograms of critical indicators of the base for each cluster were built (Fig. 1-6).

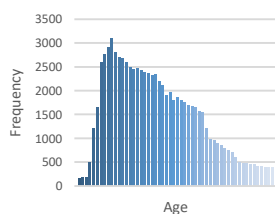


Fig.1 Cluster: no-repeat purchases

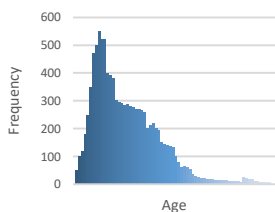


Fig.3 Cluster: 2

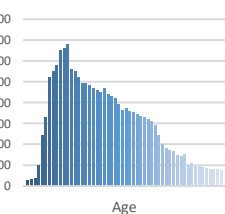
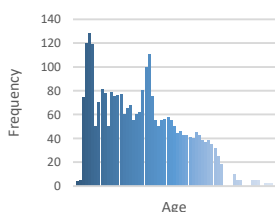


Fig. 2 Cluster: 1

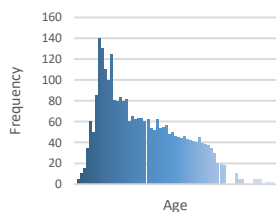


Fig.4 Cluster: 3

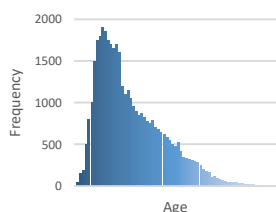


Fig.5 Cluster: 4

Fig.6 Cluster: 5

To analyze the presence or absence of significant differences by category of goods purchased for each cluster, frequency tables were compiled by the event: whether a purchase was made in this category of products or not (Table 3).

Table 3. The number of purchases of goods by category in the context of clusters

Parameter	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	no-repeat purchase	
Category 1	Purchases	43582	8704	34878	9879	27950	46764
	No purchases	13560	2650	13951	3008	8504	15769
Category 2	Purchases	8520	2304	6216	2615	4306	8264
	No purchases	52850	8745	2486	9926	32847	60039
Category 3	Purchases	8505	1865	6640	2117	430	5633
	No purchases	62354	9860	2656	11191	23540	53214
Category 4	Purchases	45890	8460	37430	9602	15710	587
	No purchases	17450	2208	14972	2506	28540	55761
Category 5	Purchases	48210	11540	36670	14098	6502	32935
	No purchases	16257	304	14668	345	1170	55756
Category 6	Purchases	8520	1605	5867	1822	34774	8264
	No purchases	61896	11250	50646	12769	14359	51265
Category 7	Purchases	5807	2450	20258	2781	22668	8250
	No purchases	54860	9053	45807	10275	58632	60483
Category 8	Purchases	605	184	18323	209	25874	44513
	No purchases	57486	10995	46491	13529	5704	16927
Category 9	Purchases	33954	6830	18596	7752	12586	587
	No purchases	57480	5702	20711	6472	2057	55761

The resulting distribution of purchases by category is presented in the form of histograms (Fig. 7). From the data of histograms it can be seen that: Category 5 is the leader in rainfall. In half of the clusters, it is in the first place, in one cluster - in the second. Category 1 is also popular (in all clusters it is in the TOP-3). As an outsider - Category 6 (in the last positions it is in 3 clusters and another 2 is below the leaders). The behavior of customers of 4 clusters is quite significant - they are dominated by purchases in the 6th category of goods, while 5 make purchases of just 4.3%.

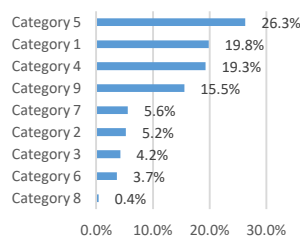


Fig. 7 Cluster: 1

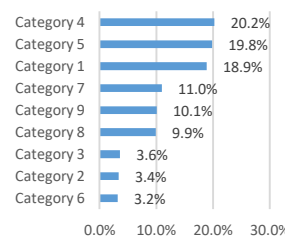


Fig. 8 Cluster: 2

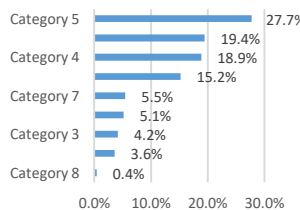


Fig. 9 Cluster: 3

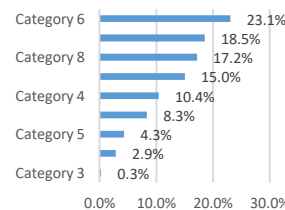


Fig. 10 Cluster: 4

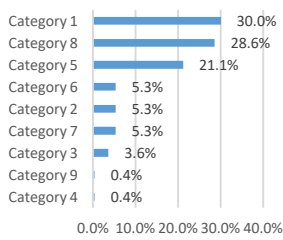


Fig. 11 Cluster: 5

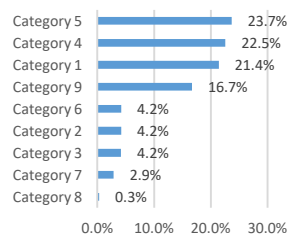


Fig. 12 Cluster: no-repeat purchases

E. Analysis of results

Based on the regression models obtained, an economic interpretation of the results obtained is presented and a strategy has been formulated for managing the customer behaviour of customer clusters depending on the tasks assigned for each cluster.

So, to retain customers in the first cluster ("ordinary customers"), a company needs to conduct mass marketing activities aimed at promoting customer purchases in the categories of cell phones, photo and video equipment, and laptops. Carrying out activities aimed at promoting goods in the types of cell phones will also increase the influx of customers from the second ("payers"), third ("middle class") cluster and the outside world.

The multi-directional effect is provided by marketing activities that offer discounts in the online store or encourage the use of financial services and payments: on the one hand, they contribute to customer retention, and on the other hand, reduce the influx of customers from other clusters. A similar effect is provided by marketing events held directly in the Kazan region - these events increase the influx of customers from other clusters into the first cluster but reduce the flow of new customers.

For the second cluster ("payers") there is no unambiguous plan of events to be held that would allow keeping the withdrawal of clients from this cluster simultaneously with attracting clients from other clusters and the outside world. Therefore, it is necessary to choose between two possible work strategies – stick to the policy of retaining customers, or the strategy of attracting new customers to this cluster.

Thus, to attract new customers, marketing activities conducted exclusively in this region and events in the categories of cell phones, photo and video equipment will be useful. Such events will also help to increase the flow of customers from the fourth cluster ("followers"), while simultaneously increasing the outflow of customers to the first group ("ordinary customers"). Those, at the same time attracting new customers, the company may reduce the quality of its customer base, facilitating the transfer of customers from a high-income cluster to a less profitable one (from "followers" to "ordinary customers").

Marketing activities aimed at promoting goods in online stores, as well as providing financial services and payments will contribute to the retirement of customers from cluster 2 to other clusters, as they increase the intensity of customer transitions to the first and fourth clusters, causing a slight inverse effect of the influx of customers into the class "Payers". The impact of ongoing marketing activities on the categories of financial services and payments to the transition of customers from the Payers cluster to cluster 1 ("Ordinary

customers") and cluster 4 ("supporters") indicates that there is an increase in the promotion of payments cross-sales of additional products and accessories.

For the third cluster ("middle class"), the influx of customers comes only from the outside world. Therefore, to increase the number of this cluster, you should use marketing activities conducted on the most popular product categories of the company: cell phones, photo and video equipment. Performing local shares in the region, on the contrary, will negatively affect the dynamics of the influx of new customers. Also, this category of clients is susceptible to marketing activities aimed at promoting financial services. Note that this type of marketing activities does not affect immediately, but with a one-month lag. Such an effect may be associated with the purchase of promotional goods on credit, at the same time advancing more favourable conditions for the purchase of products and conditions for repayment of loans. Credit purchases are made during the promotion period, and the first repayment is made in the next period, which gives a lag of 1 month. Marketing activities in the product categories of cell phones, photo and video equipment, and financial services, along with an increase in the influx of new customers in the third cluster, also contribute to customer retention. Besides, marketing activities for the promotion of laptops (with a lag of 3 months), shopping in online stores, as well as mass events on popular product categories and discounts on non-core products, influence customer retention. For the fourth cluster ("adherents") of clients, it is possible to define an unambiguous number management strategy, which will increase the influx of new clients and reduce the outflow of clients to other clusters: providing favorable conditions for purchases in online stores and using financial services, complemented by mass events for the promotion of specialized product categories of the company. It is worth noting that these events do not contribute to the influx of clients from other clusters and even have a slightly negative effect with a lag of 3 months, manifested in a reduction in the flow of clients from other clusters. A separate cluster number management strategy should be applied for cluster 5 ("dormant"). On the one hand, it is necessary to reduce the outflow of clients from the company, and on the other hand, to prevent an increase in the intensity of the influx of clients from existing clusters. So, a positive effect with a lag of 2-3 months in terms of reducing the intensity of customer retirement to the outside world is provided by marketing activities that offer favourable conditions for purchasing laptops and payments. It has been revealed that measures aimed at promoting payments also cause an influx of customers from the first cluster ("ordinary buyers"); therefore this type of marketing activities are not recommended for retaining customers. Marketing activities aimed at promoting the popular categories of products of the company and holding mass events help to reduce the intensity of customer transition from the first cluster. Adverse effect on the dynamics of changes in the number of the fifth cluster have events aimed at promoting purchases in online stores and financial services.



The nature of the impact of the events on the return flow of customers from cluster 5 (“sleeping”) to other clusters was not identified due to insufficient data – the flow rate was insignificant compared to the total cluster size.

VI. CONCLUSION

Summarizing the analysis of the nature of the impact of marketing activities on the number of clusters, the management strategy can be formulated as follows:

1. To attract new customers, the most effective marketing activities aimed at promoting the most popular categories of products and services offered by the company.
2. To retain customers, it is necessary to cross-sell non-core goods, financial services and purchases in an online store.

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