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# Determination of Priority Customers for Small and Medium-Sized Machine-Building Enterprises

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**Abstract.** The article is devoted to the selection of priority customers from among new customers for small and medium-sized machine-building enterprises. The analysis of the dynamics of sales from new and existing customers for ten enterprises allowed us to offer the coefficient of its potential as a criterion for evaluating the customer. The potential coefficient shows the increase in the cost of subsequent orders compared to the first order. The correlation and regression analysis revealed the main factors that determine the customer's potential coefficient. They are the number of years of presence in the market and the profitability of sales of the customer. The introduction of the potential coefficient in the target function of the optimization task of forming a portfolio of orders will allow you to select and retain priority customers.

## INTRODUCTION

Currently, the methodology for evaluating and selecting a customer based on market segmentation, formalized methods of ABC analysis, counterparties verifying criteria and expert assessments of enterprise managers. The development of the theory is mainly in the areas of assessing the impact of the emotional component on customer relationships [1-4]; assessing the level of customer satisfaction [5-8]; research of the impact of customer relationships and the impact on customer relationships [9-11]; research of customer behavior patterns [12, 13]. These methods used for enterprises of any scale of activity.

The trends of customization and networking of production have led to a reduction in mass and large-scale production and an increase in the number of small and medium-sized industrial enterprises [14]. The products of small and medium-sized enterprises are of two types. The first type of product is the final finished product for the B2B or B2C markets. The existing customer selection methods are suitable for this option. The second type of product is a component of a variety of more complex finished products. Therefore, it is impossible to segment the market by end customers. Customers selected based on economic criteria. The disadvantage of economic criteria is their short-term nature. As noted in [15], it is much more important than the profitability of the client that he has prospects for further increase in sales.

The selection of the customer from a possible pool of customers and the inclusion of the order in the production program is provided by mathematical optimization models [16].

The purpose of this article is to determine the criteria for selecting customers for small and medium-sized machine-building enterprises operating in a highly competitive environment and producing products of the second type.

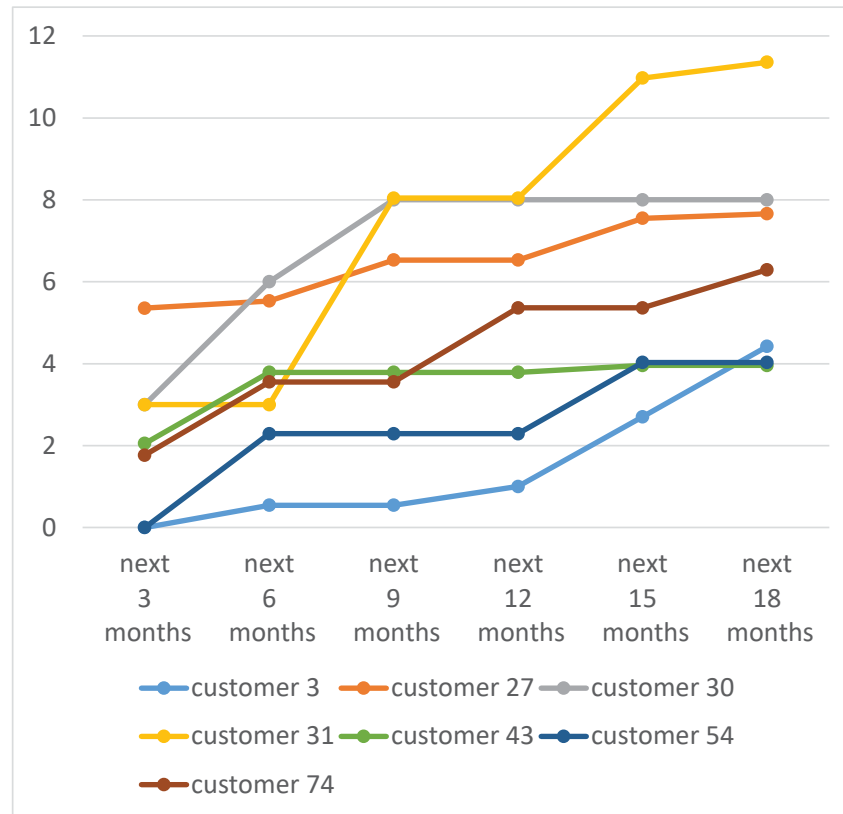
## MATERIALS AND METHODS

The sample for analysis contains 10 machine-building enterprises of small and medium-sized businesses of various industry affiliations. All the selected companies are not dependent subsidiaries and have a large and dynamic customer

pool (from 34 to 277). The stability of customers on average varies in the range of 5-10%. The percentage of customers who place only one order varies in the range of 50-70%. The number of customers who regularly place orders at each enterprise individually is only a few. Filling the order portfolio is largely due to new customers. The general highlighted problem of enterprises is the lack of methods for evaluating new customers.

The main research methods were data grouping methods, regression analysis, and optimization models.

The analysis of the dynamics of the volume of orders for new customers revealed a pattern for some customers of the volume growth over time from the volume of the first order. This shown in figure 1 for one of the analyzed enterprises.



**FIGURE 1.** Dynamics of new customers' order volumes

For each of these customers was recorded the month in which the first order was completed, as well as the total amount of revenue that was received from this customer in this month. After that, for each of these customers were calculated the sales amounts that occurred in the next 3, 6, 9, 12, 15 and 18 months relative to the month in which the first sale for each of them was made. Note that the calendar month of the first sale for each customer turned out to be different. Based on the dynamics of volumes, we calculated the growth coefficients, which can be called the customer's potential.

A comparison of the ranked lists of customers using the ABC analysis method and the coefficients found showed the absence of a direct relationship between the indicators. Thus, the assessment of the existing order volume and the assessment of the potential of orders when retaining a customer differ significantly.

The factors that determine the value of the "customer potential" were selected based on publications and a survey of managers. Thus, [15] suggests taking into account the dynamics of customer sales, [17-20] take into account profit, [21] evaluate the number of target indicators (revenue, costs, profit profitability), [22] evaluate the degree of consumer reliability. We have additionally introduced the "number of years on the market" factor. At the same time, the influence of the following technical and economic factors was studied: authorized capital, number of employees, revenue, growth and revenue growth rates, net profit, return on sales, output per employee. The paired analysis of the indicators showed the absence of multicollinear connection, which allowed us to build models of multiple correlation.

## CONCLUSION

The problem of determining the characteristics of the customer's potential was solved using correlation and regression analysis. The model using all the factors did not pass the validation test according to the criteria of Fischer and Student. The results of other models that use a limited number of indicators are shown in table 1.

TABLE 1. Models results

| Models  | R-square | X-variables                   | P-Value  |
|---------|----------|-------------------------------|----------|
| model 1 | 0.712008 | number of years on the market | 0.000023 |
|         |          | profitability of sales        | 0.073289 |
|         |          | revenue growth rate           | 0.718587 |
| model 2 | 0.639801 | number of years on the market | 0.000039 |
| model 3 | 0.000243 | profitability of sales        | 0.949487 |
| model 4 | 0.599153 | revenue growth rate           | 0.000101 |
| model 5 | 0.650817 | revenue growth rate           | 0.487640 |
|         |          | number of years on the market | 0.143441 |
|         |          | number of years on the market | 0.000012 |
| model 6 | 0.709419 | profitability of sales        | 0.067919 |

Such indicators as the growth rate of revenue and the profitability of sales of the customer do not have a close relationship with the coefficient of the customer's potential. The factor that determines it is the "number of years on the market". This is consistent with the methodology of economic sustainability of the enterprise. The factors of scale and profitability are not significant. Many enterprises choose large enterprises as priority customers, without taking into account their competitive strength or, according to M. Porter, "the ability of the buyer to bargain". Pressure from large customers is accompanied by a decrease in profit, efficiency of order processing and payment. At the same time, medium-sized enterprises have a more flexible pricing policy, are less bound by procurement procedures, and if they successfully operate on the market for 10 years or more, they can be considered promising customers.

The specifics of the product and the market do not allow us to deduce a single value of the customer's potential coefficient. A comparative analysis of enterprises that produce components for hydraulic equipment, equipment for cleaning pipes in oil production, hardware products, engaged in machining small batches of precise parts, showed that the trend of the dependence of the customer's potential coefficient on the "number of years on the market" is present, but the numerical values of the coefficients are different.

To estimate the average potential of the customer, you can use the resulting equation (1).

$$k = 0.3x_1 + 5.477x_2 \quad (1)$$

Variables:

- x1 – number of years on the market,
- x2 – profitability of sales.

The information required to determine the customer's potential coefficient is publicly available, for example, on the website [www.list-org.com](http://www.list-org.com).

This coefficient can be used to build an optimization model for the formation of a portfolio of orders. The target function [16] will look like this (2).

$$\begin{aligned}
 T &= MC(p) + MF(p) - L(c) \rightarrow \max \\
 MC(p) &= p_1m_1 + \dots + p_im_i \\
 MF(p) &= (p_1k_1 + \dots + p_ik_i)m_s \\
 p_i &= \{0,1\} \\
 L(c) &= c_1l_1 + \dots + c_il_i \\
 c_i &= \begin{cases} 1 & \leftarrow p_i = 0 \\ 0 & \leftarrow p_i = 1 \end{cases}
 \end{aligned}$$

$$\left\{ \begin{array}{l} \sum_{i=1}^i r_{1i} \leq R_1 \\ \dots \\ \sum_{i=1}^i r_{Ei} \leq R_E \end{array} \right\} \quad (2)$$

Variables:

$p_i$  – boolean variable reflecting inclusion (1) or not inclusion (0) of i-th order in production program,  
 $c_i$  – boolean variable, reverse  $p_i$ , indicating presence (1) of losses due to cancellation of i-th order or their absence (0).

Parameters:

T – the total economic result from the implementation of the production program,  
 MC(p) – total current marginal income from the implementation of the production program  
 MF(p) – total future expected margin income from the implementation of the production program  
 $m_i$  – margin income of the i-th order,  
 $m_s$  – margin income of the standard order,  
 L(c) – total possible current losses from cancellations of orders,  
 $l_i$  – possible losses from cancellation of i-th order,  
 $k_i$  – customer's potential coefficient of the i-th order,  
 $r_{ei}$  – the number of limited resources e required to complete the i-th order,  
 $R_i$  – the total number of limited resources e that is available

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