

Cluster analysis as a tool for managing and forecasting target cost in poultry organizations

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Abstract — Under the current conditions of a competitive market environment for poultry organizations, it is necessary to focus on market prices, establish a target price on their basis and, accordingly, determine the target cost in order to exercise strategic management of the organization.

In this study, it is proposed to use the concept of Target Costing - target cost planning in poultry farms. The basis of the concept of this system is a change of view on the relationship between price, profit and cost. The concept of target cost in relation to poultry organizations. The main condition for the calculations is the price at which sales can be made in the planned volumes, and profit, a decrease in the amount of which deprives the sense of working on this product. The result of the calculations is the cost, which must fit into the design, manufacture and promotion of the product.

The calculation of the target cost based on data on the costs of the poultry organization by product.

The cluster cost analysis was carried out on the basis of target, minimum possible, maximum allowable and actual costs in the poultry farming organization, which makes it possible to control the values of the target cost and its deviation from the actual cost.

Having carried out cluster analysis in the poultry-farming organization, conclusions were drawn on the correspondence of the target cost price to the actual, so in some cases the target cost price is overestimated, and the actual cost price is close to the minimum possible. This suggests that the organization receives a target profit, and there are opportunities for its increase.

Keywords — target cost, costs, poultry organizations, cost of production, cluster analysis, types of products, target rate of return, target price, cost management, pricing, price, Cluster analysis.

I. INTRODUCTION

Currently, taking into account the national priority for supporting agricultural producers declared by the President of the Russian Federation (with emphasis on creating conditions for the development of animal husbandry), the development of poultry farming, especially its meat industry, is becoming an important and strategic target for ensuring the country's food security, one of the tools for implementing effective rural farms.

Under the prevailing conditions of a competitive market environment for the strategic management of the poultry organization, it becomes necessary to focus on market prices, establish a target price on their basis and, accordingly, determine the target cost price.

The aim of the study is to calculate the target cost in poultry organizations and apply cluster analysis based on target, minimum possible, maximum allowable and actual

costs in the poultry organization, which allows you to control the values of target cost and make operational management decisions aimed at maximizing the final financial result. The objectives of the study is to calculate the target cost in integrated poultry organizations by product and to conduct a cluster analysis based on data from poultry organizations.

The theoretical significance lies in the synthesis of scientific and applied developments of domestic and foreign economists and practitioners on the issues of cost formation and the calculation of production costs.

The practical significance lies in the use of conclusions and proposals for solving the problems of effective management of the cost price of poultry farms in the practice of management.

II. LITERATURE REVIEW

There are a lot of basic research in the field of management, cost formation and costing of products.

In our country, the study of cost formation, costing, formation of financial results were considered in the works of A.F. Aksenenko, R.A. Alborova [1], V.K. Belyaev [2], P.S. Bezrukikh [3], L.V. Gulyaeva AV, Rasputin [4] and others.

Maximova [5], Yu.M. were engaged in research of management, economics and organization of poultry production at different times. Minkin [6], S.S. Ovanesyan [7], Odinokova T.D. [8], M.Z. Pizengolts [9], V.I. Samarukha [10], A.V. Samaruha [11] and others.

Considering the modern development of the agro-industrial complex, Odinokova TD believes that "... the ban on the importation of food products from a number of countries in Western Europe and North America and the rise in world currencies against the ruble allowed us to increase the competitiveness of agri-food products in the domestic and foreign markets, to increase production volumes and thereby maintain a steady dynamics in the development of the industry ... The rise in prices for basic food products led to changes in the structure of consumer goods. in the direction of growth in demand for cheaper segments, which was the result of a reduction in real incomes of the population."

The use of modern systems of analysis and management accounting, including the concept of Target Costing in modern enterprises of various industries, is considered by such authors as D. Slavnikov. [12], Slobodnyak I.A. [13], Sukhodolov [14], Khitrova E.M. [15] and others.

According to Slavnikova D.V. "... the feedback mechanisms of traditional systems allow us to find out the estimated production costs only at the end of the product development process. If the cost of production and sales go above the market price, then the research simply has to start over.

The issues of organizing a remote analysis of risks of buckling are considered in the works of a number of Russian scientists. O.I. Lavrushin points out that the "... correspondence of the volume and structure of the information base in the performance of operations and bank risk management" [2] should be ensured. Methods for assessing the financial stability of credit institutions do not provide a reflection of an objective picture of the state of the management object. Basically they are based on a formal analysis of groups of indicators of banks. A. Yu. Simanovsky notes: "... banking supervision is sent to fixing deviations from the established norms and rules, and applying for it measures of influence to banks" [3] four].

At the same time, the interest of the Bank of Russia as a regulator consists not only in fixing the current state of the bank, but also in assessing its ability to maintain positions in the market and perform its inherent functions in an increasingly complex economic environment [5]. The curator is difficult to detect hidden adverse trends in time to take measures to eliminate them.

For Russian credit organizations and supervisory bodies, the problem of developing and using special efficient methods for analyzing and evaluating the financial stability of credit organizations that meet the conditions of the Russian market is relevant. The development of theoretical and applied aspects of decision making under incomplete information is contained in the works of A. N. Romanov and V. V. Odintsov, which describes the steps involved in creating advisory systems for approximate reasoning, systems for neural computing [6]. In the work of V. V. Kolbin, decision-making processes are considered with a fuzzy ratio of preferences on a set of alternatives [7]. A. A. Peresetsky explores the possibility of using econometric methods in remote analysis of the activities of Russian banks [8].

The tasks of determining the possible prospects for the development of risk assessment methods and the state of credit institutions should be addressed in the process of risk-oriented supervision [9]. Otherwise, the stage of assessing financial stability will be reduced to a statement of the facts that have already been identified, that is, to the control of "a-posteriori" without the possibility of the banking supervision of a preventive function. [10].

A separate task is the development of tools that implement these methods. The assessment of the state of the bank should be based on representative information, which imposes special requirements on the banking information system.

III. METHODOLOGY

As a methodological basis of the study, general scientific and special research methods were used, such as systems analysis and economic analysis methods.

The main methodological principle of system analysis is the principle of consistency. It assumes the idea of an object of any nature as a set of elements that are in a certain interaction with each other and with the outside world, as well as an understanding of the systemic nature of knowledge. The use of systems analysis methods at the stage of problem statement

allowed us to determine the main problem of the research and its external environment. Applied methods of economic analysis served as one of the methods of grouping data - cluster analysis, used by the method of selecting data on the principle of "nearest neighbor".

IV. MAIN PART

The basis of the concept of Target Costing - target cost planning is a change of view on the relationship between price, profit and cost. The traditional method of pricing in poultry organizations is described by the formula:

$$\text{Price} = \text{Cost} + \text{Profit} \quad (1)$$

It is expected that the products will be able to sell at a price that will fully cover the costs and provide the profit necessary for the further development of the organization. This approach works effectively for products that do not have competition in the market. For traditional products, the use of such a formula is only possible theoretically. Therefore, the creators of the Target Costing system changed the order of actions in this expression, and the priorities of the components changed accordingly:

$$\text{Target Cost} = \text{Target Price} - \text{Target Profit} \quad (2)$$

Thus, the main condition for the calculations is the price at which sales can be made in the planned volumes, and profit, a decrease in the amount of which deprives the sense of working on this product. The result of the calculations is the cost, which must fit into the design, manufacture and promotion of the product. In addition, the keyword "target" appeared in the formula, which imparts an aspiring and mobilizing shade to all the constituent elements of the formula.

To determine the target cost of production, the amount of profit that the poultry organization wants to receive is subtracted from the expected market price determined by the results of marketing research, based on the desired products - from manager to worker - working to design and manufacture it so that the cost price "fit into the framework of the estimated target cost.

Thus, the chain of product development actions fits into the following sequence: Target cost – Design - Actual cost

At the same time, resource providers can be involved in the cost management process, thus planning and controlling costs throughout the chain.

The sequence of formation of various analytical indicators in the process of implementation by the poultry-farming organization of the concept of managing the target cost price consists of the following steps.

1. Determination of the market price of products.
2. Clarification of requirements for functions and quality.
3. Setting a target profit for the product.

Based on the proposed concept, we calculate the target cost for poultry organizations in Table 1.

TABLE 1. THE CALCULATION OF THE TARGET UNIT COST OF PRODUCTION FOR POULTRY ON THE PROPOSED COST ACCOUNTING SYSTEM

	Яйцо инкубационное	Яйцо товарное	Мясобройлеров	Суточный цыпленок

Market (retail) price, rub.	11	4,5	70	30
Trade allowance, %	30	30	30	30
Target price, rub.	8	3,2	49	21
Target rate of return, %	20	20	20	20
Target profit	1,6	0,4	0,4	9,4
Planned sales, thousand pieces, tn.	37	150	900	54
Actual cost, rub.	2,09	0,57	19,17	8,93
Target cost, rub.	6,4	1,6	36	16
The difference between the actual and target cost per unit	4,31	1,03	16,83	7,07

* Calculated based on data from the poultry industry of the Irkutsk Region

Analyzing table 1 it is necessary to perform the following algorithm of actions, presented in Figure 1.

Having determined the market price of products, excluding the mark-up at retail from it, we will determine the target price at which the products produced in the poultry-farming organization can be sold. In order to determine the target cost, you must subtract the target rate of return from the target price. If the target cost \geq the actual cost, it can be argued that the products provide the organization with a target rate of return.

As can be seen from table 1, all manufactured products in the poultry organization are profitable and provide the organization with a profit rate of 20%. The difference between the planned and target cost shows how much the costs can be increased by type of product.

The proposed target cost as a management concept has a number of advantages and advantages over other methods of cost control:

1) the existence of financial restrictions sets a rigid framework for technologists, livestock specialists, supply and sales services.

2) integrates many organizational functions.

The aim of our study is to determine the difference in the actual cost of production in the poultry farms of the Irkutsk region and the target cost calculated by us in an expert way. To predict the target cost, we suggest using cluster analysis. Cluster analysis allows using the mathematical apparatus to group a set of indicators (in our case, these are data on the costs of producing the main and related products by business units over time) characterizing the set of objects (target, actual, min-but acceptable and max-possible) in classes (clusters). The purpose of the cluster analysis is to determine the significance of the deviation of the target cost from its actual value. If the objects (target and actual cost) fall into one cluster, this indicates a slight deviation, which means that the actual poultry-farming organization gets the target profit, but if they do not fall into one cluster, then it is necessary to carry out cost adjustment, i.e. find ways to reduce them in order to reduce the actual cost. Currently, there are many works devoted to cluster analysis. The authors distinguish a certain set of stages of cluster analysis. Without going into the mathematical description of the method, we will present the

stages of cluster analysis, which are necessary for our research in order to control deviations of target and actual cost from authorities of the poultry organization.

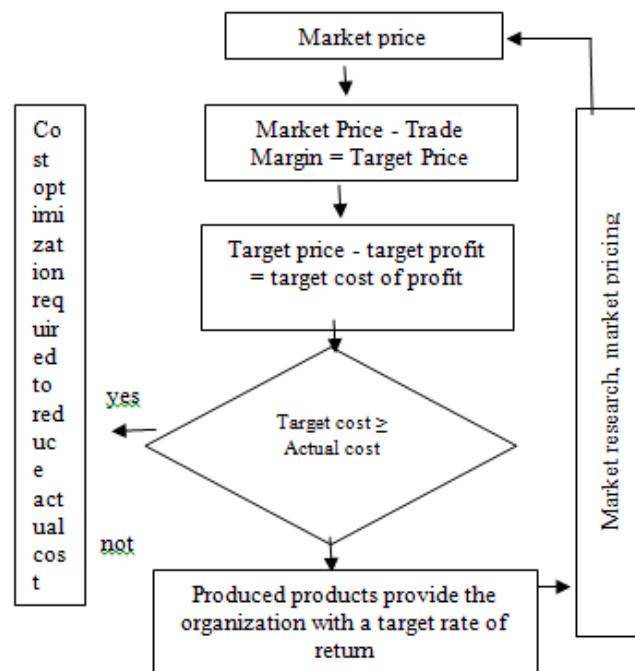


Fig. 1. The algorithm for determining the target cost in poultry organizations

First stage. The choice of objects of study. Objects of clustering we call the values of the target cost, the actual values of the cost, the maximum possible and minimum allowable values of cost. The last two values are set based on the analysis of monitoring the external and internal environment of the organization.

Second phase. The selection of a set of features that characterize the object. Signs describing the objects in question are the main cost items.

Thus, the initial data matrix will take the following form (Table 2).

TABLE 2. SOURCE DATA MATRIX

Nº p/p	X ₁	X _{...}	X _n
1			
2			
3			
4			

where 1 – values of target cost;

2 - actual cost values;

3 - minimum allowable values;

4 - maximum possible values;

X_n - cost item;

X_{ij} - the cost of the relevant article.

The main objective of the study is to determine the location of the target cost values relative to the actual values, the minimum allowable, the maximum possible values.

The third stage. Standardization of values in order to avoid the influence of the absolute value of features on the classification procedure.

Fourth stage. In cluster analysis, the concept of "metrics" is used to quantify the similarity. The similarity and difference between the classified objects is established depending on the metric distance between them.

Fifth stage. Selection of clusters. The essence of the method is that at the beginning of the analysis all the source objects are considered clusters, which will be combined during the analysis. We use the "Neighbor Neighbor Rule", which consists in combining the two nearest objects that form a new class. Then the distances from this class to all other objects are determined (the dimensionality of the distance matrix is reduced by one).

If several objects have the minimum distance at once, then there are two possible ways: choose one random pair or combine all the pairs at once.

The sixth stage. Assessment of the quality of classification by determining the total intraclass dispersion, as a quality functional.

Seventh stage. Building a dendrogram. The minimum distance between objects determines the degree of compliance of target values with actual ones. Also, it determines how close they are to the minimum or maximum values.

The clustering of two objects indicates their homogeneity. This means that they are located most closely compared with the remaining objects in question. It should be noted here that getting into one cluster 3 and 4 (minimum and maximum values) of objects is excluded, since the target values are between them.

By setting the distance between objects by the values of attributes, it is possible to determine how close the actual values are to the target values. The information obtained as a result of clustering makes it possible to determine the significance of the deviation: the hit of objects 1 and 2 in one cluster indicates that the deviation is insignificant, that is, the object "fact" and the object "target" are most closely spaced to each other relative to other objects. The proximity of the actual values to the minimum allows you to talk about cost reduction, and, conversely, in the case of the actual and maximum values in one cluster indicates an increase in costs. In other cases, a signal is given that target and actual values need to be revised.

Consider the results of cluster analysis in the poultry organization of the Irkutsk region according to one quarter.

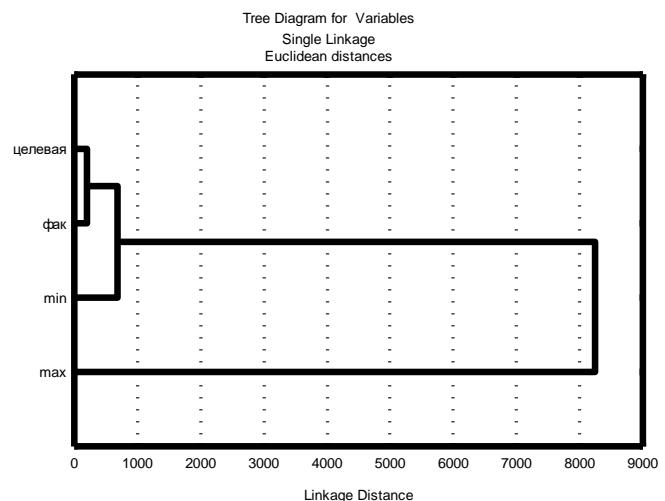


Fig. 2. Dendrogram of the carried out clustering by type of products "broiler meat"

As can be seen from Figure 2, the target cost price "broiler meat" is merged into one cluster with the actual cost price. This suggests that cost adjustments are not required, since both indicators for distance are closer to the minimum values.

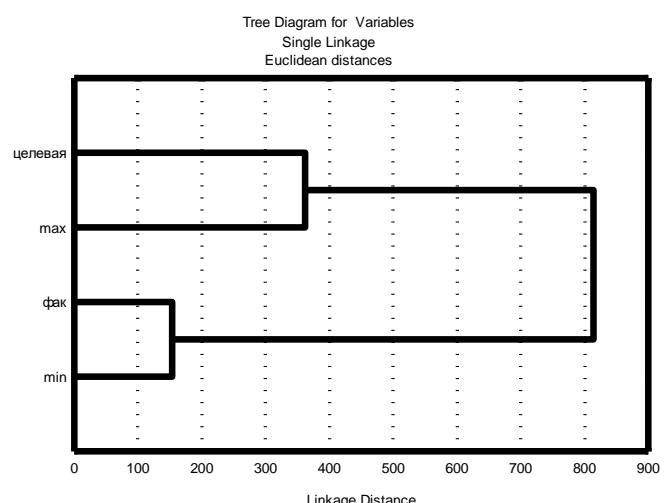


Fig. 3. Dendrogram of the carried out clustering by type of product "Egg incubation"

As can be seen from Figure 3, the target cost by type of product "Egg incubation" is combined into one cluster with the highest possible cost, and the actual with the minimum allowable, it means that the target cost is too high, the organization has opportunities to reduce the target cost, as the actual cost is close to the lowest possible.

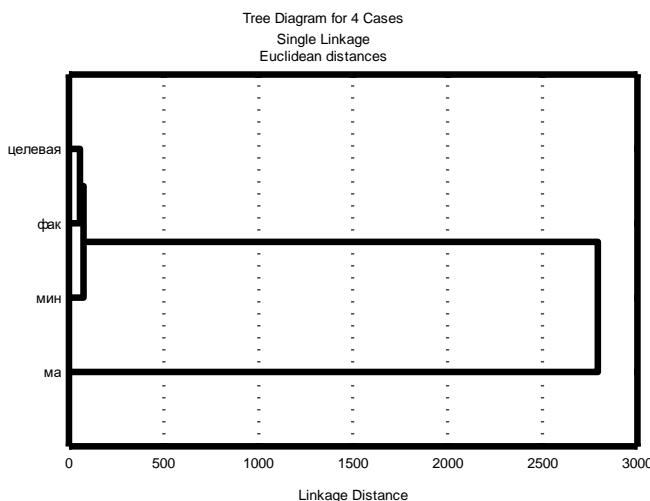


Fig. 4. Dendrogram of the carried out clustering by type of products “daily chicken”

As can be seen from Figure 4, the target cost of the “day-old chicken” type of product is combined into one cluster with the actual cost, which is closer to the minimum allowable cost. This suggests that cost adjustments are not required.

IV. CONCLUSIONS

The use of target cost in poultry organizations allows you to make calculations not only to bring new products to the market, but also to calculate how much the actual cost corresponds to the minimum allowable and maximum possible. Having carried out a cluster analysis in the poultry-farming organization based on the processing of data on costs and costs for one reporting period, we came to the following conclusions:

1. The target cost is too high in terms of the type of products produced. The hatching egg, while the actual cost is close to the lowest possible. This allows you to make an operational decision to managers of the organization to reduce the target cost.

2 In the poultry organization, no cost adjustment is required for such types of products as daily chicken and broiler meat. This suggests a competent management and forecasting of costs and allows you to continue to use the same indicators.

3. Application of cluster cost analysis based on target, minimum possible, maximum allowable and actual costs in the poultry organization provides the ability to control the values of target cost and its deviation from the actual, which will allow you to make operational management decisions.

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