# Cost structure – an important indicator of innovation activity in agro-industrial complex (by the example of crop production)

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**Abstract.** In agro-industrial complex, cost structure is of strategic importance, because it allows to determine the level of innovation activity. The study revealed diversified influence of the innovation factor (acceleration of scientific and technological progress) on the cost structure and, first of all, on the change in the ratio of share of direct labor and materialized labor in favor of the latter. Implementation of the achievements of scientific and technological progress in enterprise activities leads to a reduction in the cost of direct labor and, at the same time, to an increase in its value due to the growth of qualification requirements. Furthermore, the innovative development of enterprises assumes the implementation of intensive technologies and the acquisition of more productive equipment. In the research, all the main agricultural crops in the Pskov region (Russia) are divided into groups according to the share of direct labor and materialized labor. The effectiveness of innovative development is determined by:

• ratio of the savings from reduction of direct labor costs to the effect from implementation of the innovations, which have affected this reduction;

• ratio of the savings from reduction of material costs and energy costs to the effect from implementation of the expensive technological innovations, which have affected this reduction.

# **1** Introduction

Organization and development of any kind of activity is associated with the certain costs of current (operational) and capital (investment) nature.

It is commonly believed that capital expenditures are associated with the solution of strategic tasks, and current expenditures – with the solution of tactical problems of business activity of an enterprise, namely, with the acquisition of raw materials and supplies, maintenance of personnel, maintenance of material and technical base, etc.

However, the current costs that form the cost of production should be considered not only as the most important economic category, but also as a qualitative indicator of the level of use of all resources (of current and capital nature) at the disposal of an enterprise [1].

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It is customary to distinguish between individual and industry average cost. In contrast to the individual cost, which is due to the specific conditions of operation of an enterprise, the industry average cost is defined as weighted average unit cost in the industry.

Cost structure, which means its composition by elements or items and their share in the total cost, is characterized by the following relations [2]:

- between fixed costs and variable costs;
- between basic expenses and overhead expenses;
- between manufacturing expenses and business (nonmanufacturing) expenses;
- between direct expenses and indirect expenses;
- between human labor and materialized labor, etc.

In the field of crop production, due to biological, edaphoclimatic, agricultural features, production has sharply seasonal, time-stretched nature. For individual crops, costs for production outlay in the reporting year, but the products are harvested in the following reporting year (for example, in a winter grain crop production, etc.), some technological processes are carried out before cultivation, not to mention the output of agricultural crops. The production time of individual crops is more than one year, i.e. these crops produce a yield for 2 - 3 years. All these features of production technology require specific costs, a significant portion of which in each reporting period is a work in progress [3].

Cost structure is in motion and is influenced by [4]:

• specifics (features) of an enterprise;

• level of concentration, specialization, cooperation, combination and diversification of production;

• acceleration of scientific and technological progress;

· some other factors.

On the basis of the first factor enterprises are classified as: labor-intensive enterprises (a large share of labor costs in the cost structure), material intensive (a large share of material costs), capital-intensive (a large share of amortization charges); energy-intensive (a large share of fuel and energy in the cost structure) [5].

### 2 Methods

The innovation factor (acceleration of scientific and technological progress) affects the cost structure in many ways [6]. However, the main impact is to change the ratio of the share of human labor and materialized labor in the cost structure in favor of the latter.

The implementation of the achievements of scientific and technological progress in enterprise activities leads to a reduction in the cost of human labor and, at the same time, to an increase in its value due to the growth of qualification requirements. The effectiveness of innovative development is determined by a ratio of the savings from reduction of human labor costs to the effect from implementation of the innovations, which have affected this reduction.

Furthermore, the innovative development of enterprises assumes the implementation of intensive technologies and the acquisition of more productive equipment. The effectiveness of innovative development is determined by a ratio of the savings from reduction of material costs and energy costs to the effect from implementation of the expensive technological innovations, which have affected this reduction [7].

## **3 Results and Discussion**

In crop production, the main share of the costs for production is costs for maintenance of capital assets, labor costs, costs for seeds, fertilizers and plant protection products [8].

The share of materialized labor (material costs and amortization charges) dominates in the cost structure of crop production in the Pskov region. In 2012 this share was 67.77%, in 2017 it already was 77.83% (Fig. 1) [9].



Fig. 1. Changes in the cost structure of crop production in the Pskov region, %.

In contrast, the share of human labor decreased by 6.91% and amounted to 17.4% in 2017.

During the research period the material intensity of crop production also changed its structure (Fig. 2).

The greatest growth in the structure of material costs is shown by such items as chemical crop protection products, purchase of seeds and planting material (including elite seeds), as well as payments for services and works performed by third parties. The share of costs for equipment maintenance and purchase of mineral fertilizers is growing.

The share of fuel and electricity costs, cargo transportation and spare parts and materials for maintenance is reducing.





It is worth noting that the cost structure of the basic agricultural crops in the Pskov region is heterogeneous (Fig. 3).

A relatively high share of labor costs in the production cost, indicating the insufficient level of mechanization of the operations in crop production, presents in the production of such crops as fruits, potatoes, open-ground vegetables and protected-ground vegetables [10].



Fig. 3. Structure of the costs for cultivation of the basic crops in the Pskov region, %.

Under a high level of mechanization of grain and rape production, the share of labor costs in the cost structure is much lower, but the share of costs for the maintenance of capital assets (amortization, fuel and lubricants) is higher [11].

Depending on the share of human and materialized labor, all basic agricultural crops in the region can be divided into four groups (Fig. 4):

- 1. Group A: crops with a low share of human labor (up to 25%) and a low share of materialized labor (up to 50%) in the production cost;
- 2. Group B: crops with a high share of human labor (more than 25%) and a low share of materialized labor (up to 50%) in the production cost;
- 3. Group C: crops with a low share of human labor (up to 25%) and a high share of materialized labor (more than 50%) in the production cost;
- 4. Group D: crops with a high share of human labor (more than 25%) and a high share of materialized labor (more than 50%) in the production cost;



**Fig. 4.** Grouping of the agricultural crops of the Pskov region according to the share of human and materialized labor in the production cost in 2014 and 2017.

For the period from 2014 to 2017 the following changes have taken place in the distribution of the basic crops of the region:

- 1. Group A was freed from haylage-making, silage-making and winter rape and, at the same time, had been joined by protected-ground vegetables;
- 2. Group B was freed from protected-ground vegetables and other crops, preserving fruit crops, natural hayfields and pastures;

- 3. Group D was freed from open-ground vegetables, improved hayfields and pastures;
- 4. Group C accumulated the biggest variety of crops in crop production of the region.

Besides the heterogeneity of the cost structure of the basic crops in the Pskov region, a ratio of the share of human and materialized labor of municipal units of the region also varies (Fig. 5).



**Fig. 5.** Grouping of the municipal units of the Pskov region according to the share of human and materialized labor in the crop production cost in 2014 and 2017.

In 2014, there is a fairly strong scatter of municipal units among all groups, including groups with an increased value of the share of human labor.

In 2017, besides the distribution of the basic agricultural crops of the region, there were also such changes as an increase in the concentration of municipal units in the groups with a decreased value of the share of human labor and an increased value of materialized labor (groups A and C).

Undoubtedly, the reduction of energy intensity and the growth of capital intensity against the background of the advanced growth of material intensity of crop production, the high concentration of agricultural crops and municipal units in Groups A and C indicate a certain level of innovative development of the enterprises in the industry.

## 4 Conclusions

As the important indicator of innovation activity in the regional agro-industrial complex, the cost structure also allows to identify the main reserves for cost reduction. It is a reduction of the production cost that is one of the main conditions for accelerating innovative development. It allows enterprises of the industry to form savings (a source of expanded reproduction of the fixed production assets).

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