

# Resource-Saving in Food Production: Features, Principles, Perspectives

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**Abstract** — The initiatives and business projects in the field of resource-saving and improvement of resource efficient use became particularly relevant and promising in modern economic conditions accompanied by rapid cost increase of various types of resources (raw materials, labor, production, intellectual, informational, etc.). This area of scientific research fits into the general concept of the Russian food industry strategic development in a special way. It is resource-saving that opens up new opportunities for modern food companies to increase efficiency (up to 35 %) and identify hidden reserves (up to 20 %). The subject of the study was the main features of the organization and management of the resource saving process, as well as current trends in the application of resources and wastes in domestic food production. During the research the scientific approaches as systematic, situational, logical, dialectical, and process one were used. These approaches were also implemented by using general scientific, theoretical and empirical methods. In the study some directions for resource efficiency improvement of industrial enterprises were determined as well as some principles, strategies and conditions for resource efficiency increase. General dynamics of waste generation and use in the Russian food industry was determined. It is found that food wastes are of high nutritional, energy and biological value. They are relatively harmless and easy to process by means of enzymatic and microbiological conversion or heat treatment. A very significant factor is that the potential economic benefit from the rational use of secondary resources of food production can significantly exceed the operating income from the sale of the main product.

**Keywords** — *Resource-saving, food industry, food enterprises, finished products, waste, resources*

## I. INTRODUCTION

Modern business conditions (high level of competition and its imperfection, unstable market conditions, permanent resource cost increase, low availability level of credits and loans, insufficient level of investment activity, the necessity of production capacity growth, improvement of finished products quality, ecological safety of production, as well as the desire of economic entities to increase the level of stability and capitalization) develop a promising complex of strategic objectives and tasks within the context of the resource efficiency level increase of economic entities.

The main purpose of the work was to study the theoretical and applied aspects of the resource efficiency improvement of food industry enterprises in the Russian Federation.

To achieve this purpose it was necessary to solve the following range of tasks:

- to determine practical directions of the industrial enterprises resource efficiency increase;
- to develop the resource efficiency principles relevant to the food industry and the national economy;
- to examine the types of resource efficiency strategies, implemented by industrial enterprises; to pick out the elements of resource-saving management in the companies;

- to describe the terms of resource efficiency increase at the industrial enterprises;
- to analyze the general dynamics of the ratio of waste generation and use in the Russian food industry for the period of 2005–2017;
- to formulate perspectives for the use of resource-saving technologies in food production related to the long-term strategic development.

II. PROBLEM STATEMENT

One of the strategic objectives of the modern Russian national economy, including food industry, is to increase functioning stability and efficiency on the base of resource-oriented methods and approaches. The most important tools for activating food industry potential are to reduce material and raw material expenses and losses; to increase application efficiency of feedstock and secondary resources; to identify hidden reserves in the production and management sectors and to improve labor productivity. In relation to the latter, management decisions in the field of resource-saving acquire an extraordinary role.

III. MATERIALS AND METHODS

Conducting the study, we used the following scientific approaches: systematic, situational, logical, dialectical and process one. The research was also based on general scientific methods (abstraction, definition, analysis and synthesis, induction and deduction, generalization, scientific explanation); methods of the theoretical level (idealization, axiomatization and formalization); methods of empirical research (description and comparison).

IV. RESULTS AND DISCUSSIONS

Modern business environment (as well as market, economic, political and social changes, occurring at the meso-, macro – and mega-levels) orientates management entities,

regardless of their ownership forms, scale, legal status, and industry identity, to minimize direct and indirect production costs, to develop and implement active program measures aimed at the decrease of the resource and labor intensity level, as well as at the resource consumption indicator and the finished product cost. According to the study of domestic and foreign experience, the resource efficiency mechanism has now become an important tool for improving effectiveness, sustainability and competitiveness for various business structures and government institutions [13]. It is due to the high cost of resources, their large proportion of the cost structure, as well as similar business conditions. Thus, in these circumstances, resource-saving technologies allow organizations to reduce costs significantly, to increase efficiency and to strengthen competitive advantages in the industry market [1].

Therefore, both resource-saving and resource efficiency are focused on obtaining maximum output (product) per unit of resource used. In common vision, the process of resource efficiency improvement has a clear basis for the practical application shown in Fig. 1 [2].

The research found that one of the trends in the world economy is that over the past ten years, 50–70 % of all major investments had not been used for the development of new production capacities, but for modernization of existing ones. This fact proves once again the importance and perspectives of rational use of the resource potential.

The formation and implementation of a resource efficiency strategy at all management levels is one of the most important issues of strategic management. Firstly, resource intensity is the second criterion of a product (the first is quality). Secondly, our country lags far behind developed countries in terms of resource efficiency. In our opinion, a resource efficiency strategy should be a set of principles, factors, methods, and measures, providing a permanent reduction of the aggregate resources consumption per unit of product (service) [3].

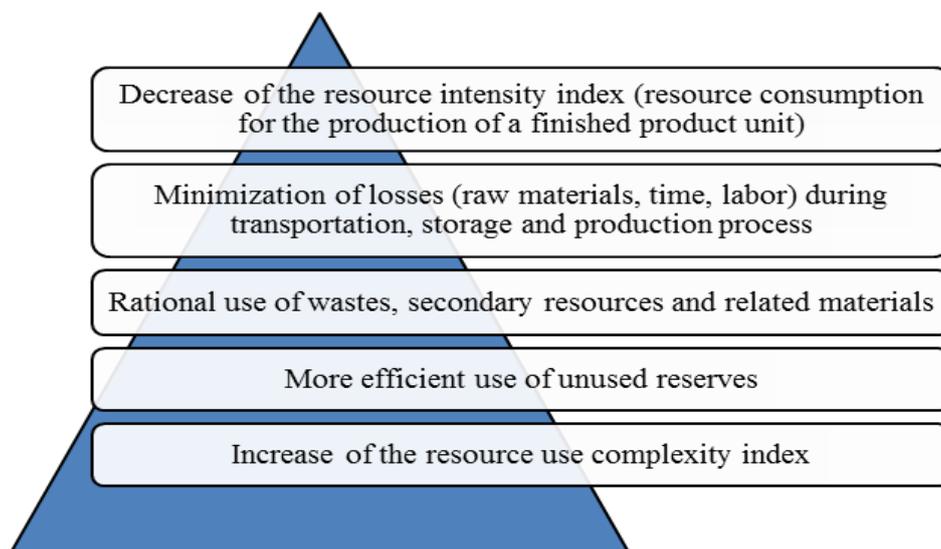


Fig. 1. Practical directions of increasing resource efficiency level of production and business activities of industrial enterprises

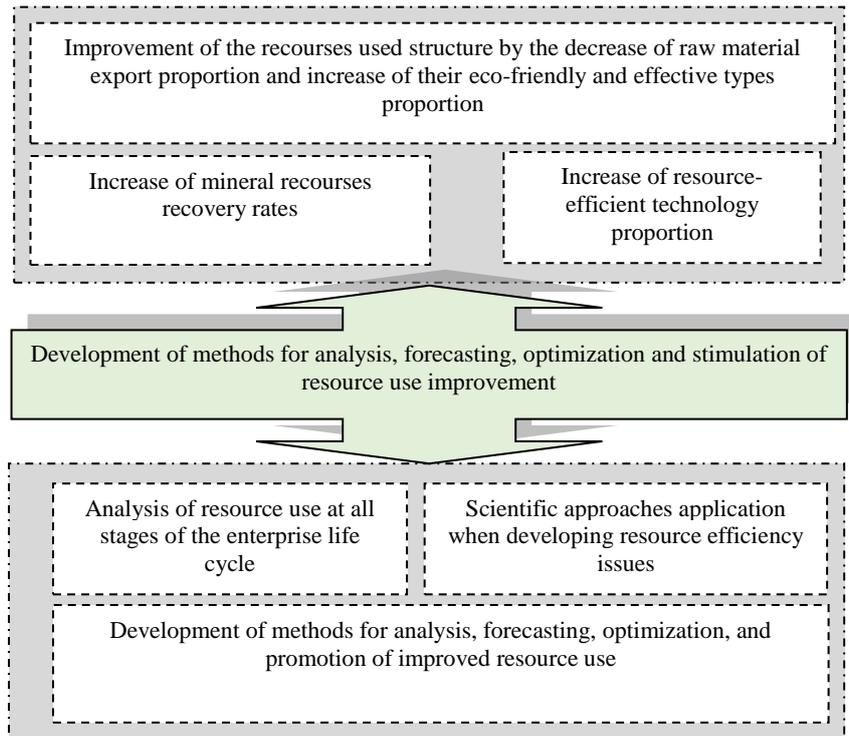


Fig. 2. Principles of resource efficiency that are relevant to the food industry and the national economy in the whole

The principles of resource efficiency which are relevant not only for food industry but also for national economy in general are illustrated in Figure 2.

At the micro-level, the principles presented must be adapted to the specific object. At the macro- level, a resource efficiency strategy should be developed for the long term (for

example, the USA has a resource-saving program for 40 years) on the base of the principles discussed above [4].

Resource efficiency strategies implemented at industrial enterprises can be quite different; the most essential ones are shown in Figure 3.

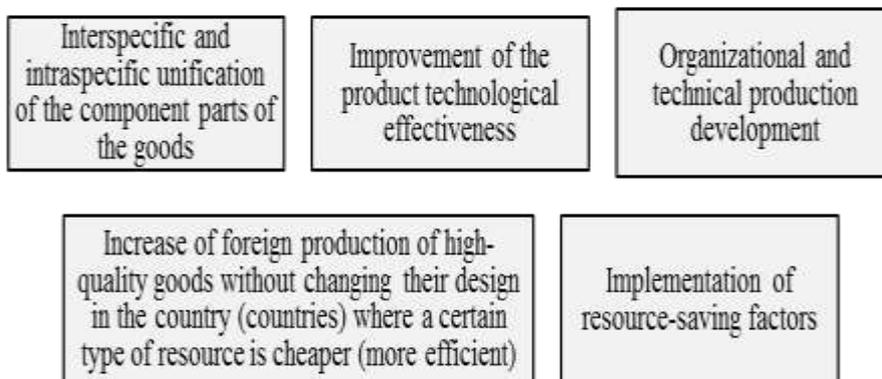


Fig. 3. Types of resource efficiency strategies implemented at industrial enterprises

The effective strategy of the enterprise resource efficiency contributes to provide high protection level of the company. This means protection of its scientific and technical, technological, production and human resources potential from active and / or passive economic threats associated, for

example, with an ineffective scientific and industrial policy of the state or the formation of an unfavorable external environment, and other factors. The process of resource-saving organization at the enterprise includes a certain basis of elements (Figure 4) [5].



Fig. 4. Elements of the resource-saving organization at the enterprise

In order to increase resource efficiency at the enterprise, it is necessary to fulfill a specific list of conditions; the most important ones are illustrated in Figure 5.

In our opinion, the resource management system at the enterprise should affect all structural and functional divisions, as well as have clear plans, mechanisms for evaluation, control, adjustment and regulation.

According to the official estimations given in the «Environmental Safety Strategy of the Russian Federation for the period to 2025», our country currently has more than 30 billion tons of wastes of different hazard classes that require attention (processing, recycling, utilization, disposal, etc.). According to the results of the study, it has been found that our country has more than 340 objects that are particularly dangerous for both environment and humans (more than 17 million people are in the high-risk zone) [6]. Nowadays there is a tendency to increase the volume of wastes that are not used. Instead, they are simply disposed and stored at landfills or thrown directly into the atmosphere, reservoirs, and soil. Ultimately, this situation can lead to the soil fertile layer contamination, loss of agricultural land productivity, and contamination of groundwater, animals and humans. It should be noted that 15 thousand authorized waste disposal facilities occupy an area of more than 4 million hectares. This area increases annually by approximately 300–400 thousand ha, but this is a potential area for crops cultivation, hunting and recreation. Thus, the problems of resource-saving, waste disposal and ecology directly determine living standards and health indicators of the country population. This fact once again confirms the relevance of such problematic issues that have a national scale [7].

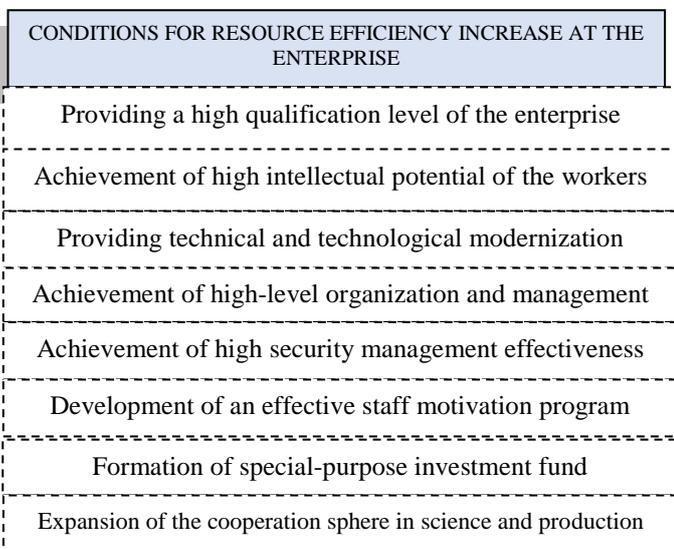


Fig. 5. Conditions of resource efficiency improvement at the industrial enterprises

It is noteworthy that resource efficiency problems are very urgent and promising for domestic food production due to some reasons:

- this inter-industrial segment has a high potential in terms of a high-quality resource base development and its rational use;
- on average, just 15-30 % of raw material is used for the finished goods production, and the rest passes into wastes and secondary resources;
- resource-oriented methods and approaches will be able to improve financial and economic situation of the food enterprises significantly;
- this is one of the most important criteria by which domestic enterprises lag behind foreign companies;
- resources used in food production have a very high cost and its growth is permanent;
- secondary resources and wastes generated are of relatively high economic and nutritional value [8].

Hence, the resource-saving type of management will help to strengthen domestic food enterprises position by identifying and including in the economic turnover all those missed opportunities that have a significant scale and no practical implementation. The general dynamics of the ratio of waste generation and use in the domestic food industry is shown in Fig. 6.

The trends in waste generation in all areas of production and consumption are similar. They have a steady growth, in particular, in 2017 compared to 2011; the increase was about 82.7 %. At the same time, their level of use in 2017 was 47.3 %, and in 2011 only 24 %. In the general dynamics, it is worth noting an increase in the proportion of food wastes used. However, compared to the indicators of advanced countries (the EU, the USA, Canada, Australia and New Zealand), where the use of this waste type proportion is more than 90 %, domestic enterprises lag far behind in terms of rationality, resource-saving and environmental friendliness of food production. It should be mentioned that the level of food raw materials use in these countries is much higher (more than 85 %) than in the Russian Federation (15–30 %) [9]. Thus, the set of tasks developed is very important for the economy and management of the domestic food industry. Note that food wastes are easily renewable. This is an economical and available source of resources. Food wastes are of high nutritional, energy and biological value. They are relatively harmless and easy to process by means of enzymatic and microbiological conversion or heat treatment. A very significant factor is that the potential economic benefit from the rational use of secondary resources of food production can

significantly exceed the operating income from the sale of the main product [10, 11, 12].

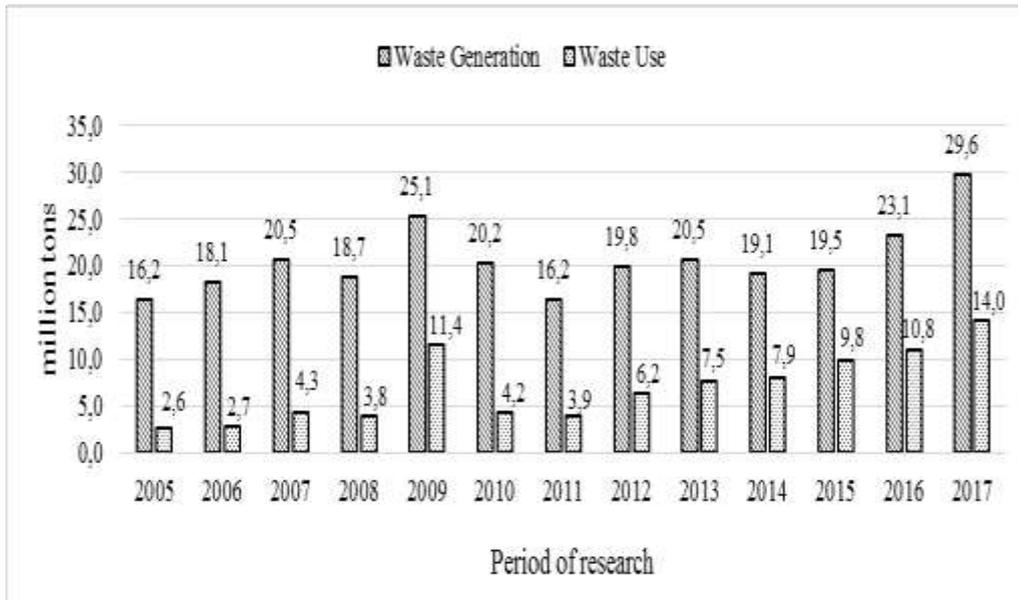


Fig. 6. General dynamics of the ratio of waste generation and use in the Russian food industry over the period 2005 – 2017

V. CONCLUSION

In the long term, the rationalization process of the resource-saving type will allow food industry to solve different problems of endogenous environment (production, managerial, financial and economic, social) and exogenous environment (social stability, food market sustainability, a high level of food security, ecological and energy balance maintenance) more efficiently. The unused resources in the form of secondary raw materials and wastes have the potential for additional economic and socio-industrial benefits.

Today, most of the food waste (more than 70 %) is not used in any possible ways (recycling, regeneration, recovery, decontamination or disposal). It is sent to the open landfills and open water reservoirs, or to the primitive treatment facilities, where a partial wastewater treatment and disposal occurs. However, the segregated waste fractions are not used. They are simply stored in a special landfill or in the public waste dumps. All this leads to the ecological imbalance and, in fact, to the high opportunity costs, which could significantly improve industrial, economic, environmental and risk-based sustainability of the enterprises.

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