A systematic approach to managing the life cycle of innovative products in the framework of implementing the Concept of Sustainability of Regions

G Rybakova[1*], I Doyko[1] and I Zobnina[1]

[1] Siberian Federal University, 79 Svobodny prosp., Krasnoyarsk 660041 Russia

E-mail: rbkv@yandex.ru

Abstract. The article discusses the key aspects of a systematic approach to the management of the range and quality of products, including the continuity of management processes at the stages of the product life cycle, as well as at different levels, such as state, regional, enterprise-producers and suppliers.

Keywords: systematic approach, management, product, quality, quality of products, product life cycle

1. Introduction

In the Concept of Development of Border Territories of the Subjects of the Russian Federation [1], among other measures for the development of agricultural potential, production and import substitution, projects are recognized, providing for the following: "the creation of agro-industrial parks and ... greenhouses for growing vegetables ..., production workshops for their processing and storage"; "the creation of cooperatives for the harvesting and processing of wild plants, bee products, berries"; "the creation of enterprises for the production of ... food additives based on biologically active substances"; "production cooperation aimed at the processing of raw materials; the creation of enterprises for the extraction and processing of natural resources ... and agricultural products" [1].

The listed complex of promising projects actualizes a number of scientific studies carried out in different years by the staff of the Department of Merchandising and Examination of Goods of the Siberian Federal University, including executed by the state task of the Ministry of Education and Science of the Russian Federation entitled "Scientific approaches to the development of the range of food products from the position of optimal, rational and functional nutrition" [2], [3]. The use of a systematic approach to this problem is dictated by the need to unite the interaction of different levels of problem solving.

Today, a systematic approach is one of the most actively developing scientific areas, based on a serious theoretical basis. Its applicability to the management of the range and quality of products is based on the consolidation of interests and efforts of the following interacting actors of the socio-economic space: federal, regional, and municipal legislative and executive authorities, consumers of goods, the research community and manufacturers of products. The most significant area of intersection of interests of these groups of subjects in modern conditions is the sphere of production and circulation of innovative products. The synergistic effects of the growth of its production and consumption for the socio-economic development of the state are due to the essence and the following

distinctive features of innovative products: new useful properties of products, using new or modernized technologies that improve the quality of life of the population, energy efficiency of production, reducing the environmental burden on the environment, rationally using traditional raw materials and engaging new resources in economic circulation, thereby strengthening the economic potential of the state. These arguments determine the high importance of a systems approach to management, the dialectical essence of which is manifested, on the one hand, in the continuity and focus of management processes at the stages of the product life cycle. On the other hand, the dialectical essence of the systems approach is manifested in the interrelation of the management functions at the following different levels: state, regional, municipal, enterprise-producer, and supplier levels.

2. Materials and Methods

The system-parametric version of the system approach developed by V. N. Sagatovsky [4] was chosen as a methodological basis. In particular, he cited three main reasons for the application of this research method [4]:

1. An acceleration of the result with excessively long waiting for the outcome of the evolutionary path of development of the object of study;
2. The complexity of the object of knowledge regarding the previously used traditional means, methods that have ceased to be effective in his study;
3. An integration of scientific knowledge in the study of interdisciplinary problems at the junction of several sciences.

All three conditions are present in the developed topics. Management of the range and quality of products, considered by economics as a problem from the beginning of the twentieth century, do not have a satisfactory system point of view on the essence of the problem under study up to the present day. In modern conditions, the high dynamism of the variability of the environment of the object of study requires prompt decision-making regarding organizational changes that arise as a response to the current and forecasted environmental challenges. Such a specific object as "assortment and product quality management" is analyzed. It is the subject of study not only economics but also management, psychology, cybernetics, and other sciences. Its complexity is determined by the multidimensional dialectic character. Under these conditions, previous research approaches based on one-dimensional ideas about the essence of the analyzed phenomenon cease to be productive. At the same time, the linear-functional structures, traditional and dominant in business, administrative and public management, focused on a stable external environment, cannot provide the required dynamism of organizational changes.

The authors showed the features of the application of a systematic approach to the management of the range and quality of innovative products in relation to the life cycle of products based on vegetable food raw materials with the following biologically significant active principles: adaptogenic and immunostimulating action (*Rhodiola rosea, Echinacea purpurea*), the source of sugar substitutes (stevia) obtained in greenhouse conditions by regulating nutrient substrates and changes in the spectral composition of light [2], [3].

3. Results

Considering the object of study as a system from the point of view of the system-parametric version, the selection of the following three groups of factors is necessary: system-generating; system-forming; system-determining [4, p. 15].

Management of the life cycle of innovative products includes the following: analysis of the resource base and properties of resources that are promising for the formation of new consumer characteristics of products; surpassing the existing analogues in functional, ergonomic, ecological properties, safety and reliability in consumption; searching for new ways of obtaining and reproducing raw materials; developing and optimizing new technological regimes and methods for processing raw

materials aimed at creating a product with improved or fundamentally new consumer properties; implementing a marketing strategy to promote a new product to the market; taking into account the characteristics of the target consumer segment and the emerging competitive conditions; providing informational support of the product, revealing its advantages for both direct users and indirectly interested parties.

The peculiarity of the presented research, which distinguishes them from the generally accepted methods of quality management and the range of products, are other system-generating, system-forming, and system-determining factors than are customary in trade management and production organizations. This is due to the fact that the goal-setting in the presented research is determined, first of all, not by the objectives of the enterprise as a subject of market relations but relies on priorities in the field of safety and health of the nation, development of border regions [1], which is indicated in government documents [5-7].

The presence of such significant benchmarks in the analysis of the studied quality management system and the range of food products allows us to formulate two groups of factors from three groups (system-generating and system-determining) from the standpoint of the level of state interests set forth in the above documents.

The system-generating group determinant includes target state and contradiction.

In this case, the main exogenous goal directly determines the satisfaction of the consolidated interests of all interacting subjects of the socio-economic space (federal, regional, and municipal authorities, consumers of goods and services, product manufacturers). Lower-ranking goals related to a system view on assortment and product quality management are only of an auxiliary nature. In particular, they prepare the ground for the subsequent procedure of its optimization. Due to the fact that the degree of development of systematicity may be different, for the present study it implies an approach to the management methods not only of the range and quality of products but also of the factors forming them.

The contradiction between the direction of development of the object of study and the possibility of providing it includes the following range of contradictions: between the interests of various categories of interacting subjects of the socio-economic space; between production possibilities and market needs, etc. In addition, the internationalization of business, the “erosion” of national, regional borders, the increasing dominance of transnational corporations in world markets give rise to many contradictions, closely related to the traditions, ethnic, socio-psychological, and political characteristics of the population of large regions of the world. Such problems are complex, systemic in nature. It is difficult to identify the hierarchy of the importance of existing forces and development factors. The resolution of these contradictions is possible through the use of a systematic approach. The identification of this determinant is the most important methodological prerequisite for the system representation of the socio-economic phenomenon under study.

The system-forming group of factors includes properties, composition, structures.

Products, like any material object, have a combination of physical and chemical properties. However, in addition, products as a commodity are endowed with certain consumer properties. These are usually attributed functional, ergonomic, technological, aesthetic, environmental, and other properties. Thus, the management of the range and quality of products involves managing the goods properties.

The second of the group of system-forming factors is the composition of the system (a set of elements included in it). The specificity of our approach to the study of the object of study involves an analysis of such elements as raw materials, semi-finished products, finished products, goods.

The third and last factor of the group of system-forming groups is the structure, which is understood as the constancy of relations and the connection between the elements.

The process of managing the range and quality of products is a unique socio-economic phenomenon, which is complex in the following several respects: its own nature, information, structure, volume, etc. At the same time, the complexity taken in relation to the structure of the phenomenon under study implies its tier organization (at the level of an individual enterprise, industry,

region, etc.), which in turn sets the corresponding levels of connections of the existing system elements.

The third group of factors determining the formation of a system is "system-determining." They are determined by environmental conditions and impose a set of restrictions on the preservation, functioning and development of an object as a system, ensuring its reproduction within specified limits. In general, they can be represented in the form of the following three groups: economic, managerial, social.

The first group includes the restrictions imposed by the nature of the object under study on the system of managing the range and quality of products. They are expressed in the desire of the organization to break-even, increase profitability and are designed to resolve the contradiction between the capabilities of the enterprise and the needs of the market.

The bans associated with the management are due to the existence of a strategy for the operation of a separate enterprise, industry, as well as with the presence of state regulation in the case of socially important products.

The prohibitions related to the social aspect of the research is a concrete resolution of the contradiction between the interests of various categories of interacting subjects of the socio-economic space. These include federal, regional, and municipal legislative and executive authorities, consumers of goods and services, manufacturers of products.

4. Discussion

A feature of the shown approach is the attraction of additional factors of the external environment and internal management capabilities into the system, considering which, the possibility of shaping the needs of the end user while respecting the interests of the state level in relation to the health of citizens appears. The content of factors in the presented systems is wider than is customary to consider them within the framework of one functioning enterprise, since it includes higher-level goals, secured by state development concepts in relevant spheres of life and the associated contradictions.

The application of the approach to innovative food products is justified by the importance of the food factor in ensuring the safety and quality of life of citizens, declared in several governing documents at once. The possibilities of expanding management functions not only at the stages of the production technology of the final product, but it is also in the production of such raw materials are shown in examples of creating products using plant materials with different active properties [3].

Studies related to the control of parameters in light-culture conditions [2], [3], with a general similarity of technologies (changing the spectral composition of light), had different points of control and comparisons. The goal-setting of these studies was expanded to the creation of products for various purposes, the physiological influence of which was determined by the properties of the active principle (diabetic, immunostimulating, adaptogenic orientation). From the point of view of human ecology, its presence in implementation can allow at least partially mitigate the problem of increasing immunity and adaptability of the population to the harsh working and living conditions, as well as unfavorable environmental conditions associated with human activities.

Controlling a spectral composition of light allows one to increase the efficiency of application of radiant (and hence electrical) energy in greenhouses, thereby reducing costs and bringing the source of plant materials to the places of production of innovative food products. In the production of innovative products in the regions, the light-culture method can be justified because of the lack of a real opportunity to regularly deliver fresh raw materials and store them for a long time in the field without reducing biochemical indicators. The impact of the spectral composition of artificial light on plants makes it possible to shorten the period of obtaining raw materials without reducing the content of the active principle, which is impossible for the natural growing conditions. This is where the biomass does not have time to reach the necessary production and biochemical parameters for its preparation as a raw material during the short growing season.

5. Conclusion

The presented ways of implementing a systems approach in managing the quality and range of products and services do not exhaust all the possibilities of its use but only indicate the vector of scientific research and practical application of the methodology in further developments. Expanding and deepening the concept of management with regard to the range and quality become possible when state priorities are included in the complex of environmental factors, including in the area of ensuring the health and safety of citizens. Technological parameters for obtaining significant raw materials at the "pre-production" stage were added from internal factors.

6. Acknowledgments

The authors are grateful to Doctor of Biological Sciences, Professor, Head of the Laboratory Managing Phototrophic Biosynthesis of the Institute of Biophysics of the SB RAS Tikhomirov Alexander Apollinarievich, and also to the Doctor of Pedagogical Sciences, Professor, Head of the SFU Department of Commodity Research and Goods Examination Krotova Irina Vladimirovna.

References

[1] Government of the Russian Federation 2015 *Order of the Government of the Russian Federation "On approval of the Concept of development of border areas of the Russian Federation constituent entities of the Far Eastern Federal District"* (October 28, 2015 No. 2193-p) Available at: http://docs.cntd.ru/document/420313859 (Accessed 09 04 2019)

[2] Menyaylo L N, Baturina I A *et al* 2015 *Scientific basis for the formation of the range of food products with desired properties: Technologies for production and processing of vegetable raw materials* (Krasnoyarsk, Russia: Siberian Federal University)

[3] Gulenkova G S, Demakova E A *et al* 2016 *A systematic approach to managing the range and quality of products* (Krasnoyarsk, Russia: Siberian Federal University)

[4] Sagatovsky V N 1982 *Systemic activity and its philosophical understanding: Materialistic dialectics and systems approach* (Leningrad, Russia: LSU)

[5] Government of the Russian Federation 2008 *Order of the Government of the Russian Federation "On the Concept of the long-term socio-economic development of the Russian Federation for the period up to 2020"* (November 17, 2008 No. 1662-p) Available at: http://docs.cntd.ru/document/902130343 (Accessed 09 04 2019)

[6] Presidential Executive Office 2015 *Presidential Decree "On the National Security Strategy of the Russian Federation"* (December 31, 2015 No. 683) Available at: http://docs.cntd.ru/document/420327289 (Accessed 09 04 2019)

[7] Government of the Russian Federation 2010 *Order of the Government of the Russian Federation "On the approval of the Fundamentals of the state policy of the Russian Federation in the field of healthy nutrition of the population for the period up to 2020"* (October 25, 2010 No. 1873-p) Available at: http://docs.cntd.ru/document/902242308 (Accessed 09 04 2019)