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Sustainable Food Production and Strategic Management

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Abstract:

These days, sustainability is a key issue for many private companies that address their sustainable corporate performance. The perspective is essential for their license to operate and forms the basis for business principles and practices. The lack of internationally accepted reporting standards on what, when and where to report makes it difficult to assess sustainability. The article examines different sustainable methods to forecast the development of food sector in Kazakhstan. The scenario approach is used as the most effective one that, in the authors' opinion, allows taking into consideration a variety of tendencies in the sphere of production, distribution and consumption of food products. Kazakhstan has real opportunities to produce a wide range of food products in the volume, that ensure not only food security of the country, but also the possibility of expanding the export potential of Kazakhstan both at the expense of raw materials and the realization of food products on the world markets with high added value. Currently, however, the food potential of the country is being used inefficiently.

Keywords: sustainable management; raw materials; food production; forecast

JEL Classification: Q0 ; Q1 ; Q5

Introduction

Kazakhstan has real opportunities to produce a wide range of food products in the volume, that ensure not only food security of the country, but also the possibility of expanding the export potential of Kazakhstan both at the expense of raw materials and the realization of food products on the world markets with high added value. Currently, however, the food potential of the country is being used inefficiently. This is evidenced, first of all, of irrational pattern of food products import, most of which could be produced at domestic plants (Belov 2001). In these conditions it's necessary to look for more appropriate scientific approaches to organize strategic management of food sector's fields on the basis of analysis improvement, planning and forecasting of progress trends of internal and external food markets.

1. Research Background

In Kazakhstan in different sectors of national economy in the elaboration of developing forecasts a program target-oriented approach is widely used. The theory of target management is described in the works by Drucker P. (Drucker 2001).

Strategic development of Kazakhstan's food sector covers a wide range of medium-and long-term goals.

The most appropriate method from the existing amount of methods and techniques of long term socio-economic forecast for the food sector is a method of alternative forecast scenarios. It is exactly the method of alternative forecast scenarios that reflects the needs of strategic forecasting in the complex web of conflicting trends in the global economy is used. It is recognized that in the conditions of fast and controversial changes is no longer possible to use methods of forecasting based only on the extrapolation of existing trends of technical, technological, economic and social development. The experts have doubts about the attempts of multivariate quantitative forecast of the dynamics of the world market's opportunities and the tends of development in particular spheres of industrial and commercial activity. The method of alternative forecast scenarios enables a holistic view of the socio-economic systems' development with a limited number of strategic scenarios, each of which has the objective preconditions for the realization in the distant future (20-30 years), but with a different degree of probability (Drucker 2007).

To apply the techniques of alternative forecast scenarios the specifics of the food sector in Kazakhstan: geopolitical, socio-economic, socio-psychological, organizational and economic features that have a significant impact on its development should be taken into account.

2. Methodology

The problem of improving state regulation of the agro-industrial complex is the most important part in the market mechanism of the economy in the post-crisis period (Kamenova and Omarova 2017). In our opinion, to predict the development of the food sector five scenarios of long-term development, that allow to take into consideration more differentially diverse trends of production, distribution and consumption of food products: pessimistic, moderately pessimistic, neutral, moderately optimistic and optimistic, should be used. In addition to three basic scenarios are developed moderately pessimistic and moderately optimistic scenarios that reflect the complex web of positive and negative factors in the development of the food sector with a corresponding prevalence of either negative factors in the external socio-economic environment or the predominance of positive trends. Already at the stage of the selection of five alternative forecast scenarios their disparity should be noted, namely, pessimistic and neutral scenarios do not reflect the actual state of affairs in the domestic agribusiness and, especially, long-term business prospects of the producers of Kazakhstan in the overall context of existing strategic challenges in the conditions of globalization. Only optimistic and moderately optimistic scenarios can be considered as more realistic ones.

The expediency to take into consideration the low-probability scenarios of the food sector's development is caused by that fact that positive factors can not be marked out without simultaneous consideration of negative factors (though they can be absolutely different in the force of impact). If the factors of food sector's steadiness are marked out, so the risk factors should be taken into consideration, meanwhile positive factors should be considered together with negative trends (Gordievsky 2007).

In developing the pessimistic scenario it's very important to foresee so-called hidden threats of deterioration of social and economic environment that are more clearly tracked in the development of this scenario. Meanwhile, the usual practice is to combine the development of alternative scenarios with the release of one that then is being developed in detail. Two-step methodological approach, that is, the consideration of five alternative scenarios in general, and then more detailed study of the most probable scenario, fully reflects the specificity of long-term forecast's food sector as a complex of natural biological and socio-economic system.

The pessimistic scenario is based on finding the main adverse factors, and forecasting of their joint impact on the development of the national food industry. According to the pessimistic scenario the slow pace of the food

sector is assumed. Moreover, it's predicted the decline of competitiveness of domestic producers' food products in the conditions of the aggressive promotion to the food markets of Kazakhstan the food produced in other countries. The basic model of strategic development of the food sector according to the pessimistic scenario indicates the threat of the modernization processes' slowdown and even the loss of some competitive positions, it reflects the preservation of relatively low effectiveness of the food industry of Kazakhstan, which is manifested in low yield of major crops as compared to developed countries and in poor productivity of livestock. The pessimistic scenario points to the threat of worsening of climatic conditions for the development of food sector: increase in the risk of fierce drought, increase of the rate of desertification, soil erosion and other crises. It assumes low rate of renewal of the material-technical base of the food sector, including due to the disproportionate increased cost of farm machinery and equipment for the food industry, as well as accelerated growth of prices for fuel, electricity and for services of infrastructure enterprises.

The pessimistic scenario assumes the activation of the import of foreign food products after the accession of Kazakhstan to the Customs Union and the forthcoming accession to the WTO. If the modernization of food sector is slow, it will be possible the increasing of inflow of imported food, supplied by large food corporations, which can lead to the reduction of competitiveness of Kazakhstan companies, even in the domestic market (Kenzheguzin and Kosmagambetova 2002).

Meanwhile the export of production of the agricultural sector will keep raw-material orientation. It is predicted only moderate expansion of agricultural raw materials supply in the network of already existing external economic relations with traditional buyers. In addition, under this scenario is predicted the escalation of competitive activity in the grain market due to increased grain yields in other countries, as well as decrease in the demand for bakery products due to increased consumption of other foods.

In general, the development model forecasted with the help of pessimistic scenario is not able to realize the food potential in Kazakhstan. Therefore, this scenario is unacceptable from the standpoint of the strategic objectives of sustainable socio-economic development. At the same time its structural role is to focus the attention on the real threats beginning with the deterioration of climatic factors and ending with the aggravation of competition in the global food market (Kenzheguzin and Dodonov 2005).

Considering the moderately pessimistic scenario, it should be emphasized that the probability of its realization is slightly higher than the pessimistic scenario. It corresponds with the extensively-industrial model of the food sector. This model assumes the preservation of relatively low efficiency of the functioning of the agricultural sector compared to highly developed countries. This scenario shows that gradual renewal of production and technical base of the agriculture sector and holding the special arrangements to raise crop yields, livestock sector's productivity and output capacity in the food industry can give satisfactory results. However, relatively low rate of modernization of the food sector in Kazakhstan will be insufficient to narrow the gap absolutely with highly developed countries in the level of efficiency of the agricultural sector and the food sector as a whole. Hence, the elements of the intensification of economic activities in agriculture will not radically change the general model of extensive development. Moderately pessimistic scenario does not involve a significant increase in food quality. However, there will be some positive changes due to increased income of the population. The demand for the cheapest kinds of food with obviously poor taste quality will be significantly reduced, as well as for imported food products the price of which does not correspond to their quality. According to the moderate-pessimistic scenario high dependence on food imports will remain. By this scenario significant increase of the competitiveness of domestic producers of food products in relation to importers of provisions is not expected.

This scenario is aimed at restrained assessment of the industrialization of the agricultural production. Naturally, the formation of large enterprises in the agriculture will increase the level of comprehensive mechanization of the main production processes in the crop and livestock production, but there will be a large number of small and medium-sized farms with low mechanization. In this scenario, we can predict only partial restoration of the domestic agricultural machinery construction, including through the establishment of joint ventures to build the certain types of agricultural machinery, as well as for the production of individual machines and spare parts. However, the high dependence on imports of equipment and instruments for the food sector will continue (Lopatin and Stepanenko 2005).

Summarizing the consideration of the moderately pessimistic scenario, it can be argued that the preservation of the extensive development trends of the national food sector preserves the lag behind from the high developed countries sine die. Extensively-industrial model only partially solves the problem of food production capacity. There remains a fundamental problem of improving the quality of food at fair ratio of the price level and quality of food products.

In the method of alternative scenarios the neutral scenario, which is largely based on the balanced impact of positive and negative factors, is often called realistic because of the high probability of its implementation in practice. The neutral scenario assumes the use of intense industrial model of development of the food industry. In this model, the deep modernization of all the subsystems of the food sector is carried out, fairly large horizontally integrated food companies are formed as a basis for intensive agricultural production and the formation of stable production technological and organizational and economic interrelations, covering the full cycle of reproduction of food. At the same time there are formed the integrated structures of large-scale agribusiness making connection on a contractual basis with the representatives of small and medium-sized businesses. The formation of such structures in the food sector in Kazakhstan will significantly enhance its overall efficiency and ensure competitiveness of domestic food producers in the domestic market.

Neutral scenario assumes significant increase in the quality of food production, and leads to the level of saturation of the domestic market with high quality food to the level of developed countries.

According to the neutral scenario there will remain a significant part of imported food on the domestic market of Kazakhstan. This situation will be determined by several factors from lower level of wages in some neighboring countries to much higher concentration of food production in the transnational corporations. However, imported food will not dominate in the most segments of the domestic food market, as an exception there will be only segments of tropical fruits, seafood, certain types of confectionery products and finished products manufactured according to the recipes of national cuisines of other countries. This scenario assumes a partial substitution of import of meat and dairy products with high added value.

The development of export according to the neutral scenario will occur due to increasing the supply of agricultural raw to traditional consumers from the near abroad, the expansion of agricultural raw materials into new markets, including the distant markets of the Southeast Asia and the Middle East and the gradual increase in export of food products with high added value. According to this scenario progressive changes in the framework of realization of the intensive industrial model significantly improve the competitiveness of domestic food producers, but do not allow Kazakhstan to take over the leadership on the global food market. Enhancing effectiveness of the food sector is predicted quite moderate that determines the gap in the crop yield, productivity and capacity in comparison with advanced countries. However, the neutral scenario for its implementation ensures sustainable development of food sector, food security, safe and satisfactory level of final consumption of food.

In accordance with the method of alternative forecast scenarios after the neutral a moderately optimistic scenario is examined. However, in our opinion, it should be better to go directly to the optimistic scenario, based on the probability of its realization. It is our strong opinion, that a moderately optimistic scenario for the probability surpasses all others put together. Of course, ideally, exactly optimistic scenario should be carried out, but the reality of modern market economies do not allow to suggest, even after 20-25 years that there will be complete harmony of economic interests both within the country and especially at the global level. Consequently, it's necessary to take into account the imperfections of market relations, the existence of divergent economic interests, intense competitive activity and other negative factors, impeding the implementation of the ideal development model of the food sector in Kazakhstan. The consideration of the optimistic scenario sets the overall strategic direction of the formation of a high-performance food sector.

The optimistic scenario assumes the implementation of global economic and social model of the food sector's development. From our point of view, such model must achieve the following main parameters:

- the completion of comprehensive modernization of the food sector and the achievement of effectiveness of agribusiness as in the developed countries;
- complete saturation of the domestic food market with high quality and ecologically pure food at the prices affordable for the majority of the population;
- accelerated development of export potential with the active support of the state, the organization of export of a full range of domestic food products, as well as the goods of engineering companies that produce agricultural machinery and equipment for all industries within the food sector;
- to minimize the level of imported food in the national market, maintaining full range of imported food products in all market segments;
- the formation of the complex innovation, covering the research on all aspects of agricultural science with the creation of a network of agricultural research centers across the country, the wide involvement of foreign scientists for joint research and scientific manpower's training;
- expansion of the Kazakh food producers through joint ventures in other countries under the brands of Kazakhstan.

The optimistic scenario in its nature is maximalistic, and is based on the prediction of the maximum effectiveness of the positive factors and the neutralization of the impact of negative factors. Under the optimistic scenario, priority is given to the implementation of long-term strategic goals, but these goals can conflict with the short-term goals to increase current profitability and competitiveness of farms. In general, the optimistic scenario predicts positive trends, but significantly underestimates the difficulties of strategic development, in particular the instability of the global food market.

From our point of view, the choice of a moderately optimistic scenario as a base to support long-term forecast of the food sector's development in Kazakhstan is the most realistic. In support of this choice some good reasons can be given. First, it is expediently to use the method of analogues, namely, the modernization of the food sector of close to the climatic conditions highly developed countries such as Canada and Australia, took place over 30-40 years, which means long-term nature of processes of transformation of the agriculture even in the countries with developed market economy. Second, the entering to the WTO will considerably complicate the application of direct government support for domestic food producers; therefore, will slow the formation of large capital-intensive processes of intersectoral food systems, capable of competing on foreign food markets. Third, the complete saturation of the national food market with high quality and environmentally friendly products (as according to the optimistic scenario) is not very realistic because of the significant stratification of the population by income level. Even the formation of highly industrialized society, as the experience of developed countries, does not eliminate the significant differences in the welfare of the individual layers of the population.

It is logical to recognize the moderately optimistic scenario in terms of sustainable economic growth as the most appropriate for long-term forecast of the food sector in Kazakhstan. The realism of this scenario is confirmed by the starting indicators of relatively low crop yield, efficiency and labour productivity in the agricultural sector.

In the overall context of the formation of highly industrialized society by 2030 it is logical to forecast the implementation of comprehensive mechanization and automation at all stages of food production. Naturally, the leading position on the level of mechanization and automation will take major cross-sectoral food complexes. We can predict the achievement of the level of countries with developed market economies for the most of the parameters of the organization of intensive agriculture, livestock mechanization and automation of production processes in the food industry, the computerization of business and management processes. These positive changes will help to intensify the production activities and ensure the achievement of global competitiveness in terms of crop yields and livestock productivity and output capacity in the food industry.

The basis of the mathematical apparatus is a trend model of economic dynamics. Its main objective is to develop the forecast of the process being studied for the coming period of time. This approach assumes that the predicted indicator is formed taking into account a large number of multidirectional influences, which cannot be sorted out, or there is no information about them. In this case, the variation of this index is associated with the course of time, that is manifested in the formation of one-dimensional time.

Currently, the most commonly in the economy polynomial, exponential and S-shaped growth curves are used. To carry out predictive calculations in this paper polynomial form of the curve of growth is selected, which has the following form:

$$\hat{y}_t = a_0 + a_1 t \qquad (1)$$

Parameters of polynomial curves are estimated, as a rule, by the method of the least squares, which lead to the system of so-called normal equations for determining the unknown parameters of selected curves. For the polynomial (2) the system of normal equations has the following form:

$$\begin{cases} a_0 n + a_1 \sum t = \sum y_t \\ a_0 \sum t + a_1 \sum t^2 = \sum y_t t \end{cases}, \qquad (2)$$

The forecast based on the trend models (of growth curve) contains two elements: point and interval forecasts. The point forecast is a forecast of the only value of predicted index. This value is determined by the substituting into the equation of selected curve the value of time t, corresponding to the period of forecast development: t = n + 1; t = n + 2, etc. However, the exact coincidence of the actual data in the future and forecast point estimates is hardly possible. Therefore, point forecasts should be accompanied by bilateral boundaries, *i.e.* indicating the range of values in which with a sufficient degree of certainty we can expect the predicted value. The determination of this interval is called interval prediction.

The interval prediction based on trend models is carried out by calculating the confidence interval in which with a certain degree of probability we can expect the actual value of a forecasted economic index. The calculation of confidence intervals in predicting using growth curves is based on the conclusions and formulas of the theory of regression.

However, it should be noted that regardless of the type and method of constructing economic-mathematical model, the problem of the possibility of its application for analysis and forecasting of economic phenomena can be resolved only after the determination of the adequacy of the model, *i.e.* the conformity of a model of researched process or object.

The regression equation is always complementary to the linear correlation coefficient r_{yx}. There are different versions of the formula of the linear correlation coefficient, one of them is as follows:

$$r_{yx} = \frac{y\bar{x} - \bar{y} \cdot \bar{x}}{\sigma_x \cdot \sigma_y} \quad (3)$$

where: - the dispersion of trait x;

- the dispersion of trait y;

- the linear correlation coefficient is in the range: $-1 \le r_{yx} \le 1$;

- to estimate the quality of the selection of the linear function it is calculated the square of the linear correlation coefficient r_{yx}^2, called the coefficient of determination. It characterizes the proportion of dispersion of a resultant y, explained by regression fact in the total dispersion;

- accordingly, the value ($1- r^2$) represents the proportion of dispersion y, caused by the influence of other factors not taken into account in the model.

After the linear regression equation found, both the evaluation of the significance of the equation as a whole and the individual parameters is carried out. The evaluation of the significance of the regression equation as a whole is given by the Fisher coefficient F-test. At the same time the null hypothesis is advanced that the regression coefficient is zero and, therefore, the factor x does not affect the result y. Comparing the factor and the residual dispersion per degree of freedom, the value of F-test is calculated.

Table 1. Forecast of wheat yield (by example of leading countries in the relevant market)

Calculation index	Country	Trend model equation	Average squared error of estimation	Coefficient of determination r^2_{yx}	the Fisher coefficient F-test	F-test table	Darbin and Watson coefficient, d
Crop yield, centner/ ha	the USA	Yt = 22.279 + 1.008t	1.495	0.498	1.319	5.990	2.959
	Canada	Yt = 15.366 + 1.827t	1.192	0.867	12.117	5.990	3.030
	Australia	Yt = 8.866 + 2.084t	1.160	0.901	17.211	5.990	1.582
	Russia	Yt = 11.193 + 1.069t	1.838	0.843	15.739	5.990	3.808
	Argentina	Yt = 12.188 + 2.298t	1.369	0.887	14.832	5.990	2.468

Source: compiled and calculated by authors

As a result of the above mentioned calculation algorithm the models of predictive trends for certain types of food raw materials have been found and showed in the Table 1.

According to the moderately optimistic scenario by the end of the forecast period the questions of ecologically clean food production should be solved. It means that not only large food industries, but also medium and small enterprises will adopt the system of total quality control and ecological safety of food products. The food products, arriving at the local and regional food markets, will have the same safeguards of environmental cleanliness as the food intended for export, that is, all products will correspond to international standards of quality and ecological cleanliness.

The moderately optimistic scenario emphasizes the role of humanization of the food reproduction. The complexity of this process lies in the dual nature of the market production, that is the most evident in the food sector. Food products in the condition of commodity-money relations have both the use-value and the value in the financial term. The natural desire of producers to increase the output volumes of highly profitable products in the food sector is often contrary to the interests of end consumers, who pay exactly for the use-value, that is, when buying food

products a consumer is primarily interested in a balanced diet that provides a high physical and intellectual tone of his body. This market contradiction can clearly be seen on the example of confectionery products. As a rule, confectionery production has excess profitability, so producers aggressively advertise their products, using sophisticated methods of psychological pressure on buyers to increase the demand artificially. Powerful transnational corporations have special success in blowing up the excessive demand. However, the use value of the main part of confectionery products is clearly low, moderate positive effect is achieved only when there is limited consumption. Regular consumption of a significant amount of pastry is a factor of health risk as it increases the probability of violation of digestive system and cause severe diseases such as diabetes. In this context, the humanization of the reproduction of food should harmonize the interests of producers and consumers.

Unfortunately, even according to the moderately optimistic scenario, there is no objective reason to forecast perfect harmonization of the interests of producers and final consumers of food products. The process of harmonization is very difficult and very slow. It is appropriate to draw an analogy with the eradication of smoking. The struggle of many years against smoking in developed countries is faced with the powerful lobbying of economic interests of producers of tobacco products. Paradoxically, the allies of the tobacco companies are millions of consumers who do not want to give up the habit. However, it's observed the overall positive trend of gradual decrease in the number of smokers. Naturally, the deep-rooted tradition of malnutrition, including the tendency to eat very abundant, high-calorie food is much harder to overcome than the habit of smoking. It is important to note that high-energy food is quite adequate for workers engaged in intensive manual labor, but in the terms of information society, their share will decrease rapidly. However, the traditional paradigm of abundant nutrition has high inertia, so it will be long and rather difficult to overcome it (Wilson and Starbuck 2006).

Active process of urbanization in Kazakhstan is a powerful factor in the gradual transition from traditional approaches to food organization to a new paradigm focused on the needs of workers that fulfill intense intellectual labor. It can be predicted the wide spread occurrence of ideas of low calorie, varied diet that excludes the consumption of too spicy and fatty food. The state can initiate the spread of a new paradigm of nutrition, including through a network of public catering, serving officials. The elements of rational organization of food should be promoted within a nationwide campaign to introduce a healthy lifestyle. In the media, the idea of a balanced diet can be more precise by showing examples of a positive effect on health and intellectual activities of the adherents of the new paradigm of nutrition. In general, the moderately optimistic scenario, the reproduction process of humanization of food will be fairly slow, but the general trend of prioritizing the interests of end users is predicted as stable and irreversible. Additional impetus to this trend may provide comprehensive scientific studies of beneficial effects of rational organization of all elements of the regime of healthy eating to increase life expectancy, to improve the physical body tone, and especially to the intellectual ability, high prestige and practical relevance of which do not rise doubt in the conditions of the information economy.

Conclusion

Comprehensive renewal of the food sector in Kazakhstan requires a search for new forms and methods of management, taking into account the complex web of many factors of market interaction.

Strategic development of the food sector includes a variety of scenarios for long-term forecasting of extended reproduction. Comparison of the five main scenarios from pessimistic to optimistic, suggests that the most feasible for the food sector of Kazakhstan is a moderately optimistic scenario. Realism of this scenario is confirmed by consistently high rates of economic growth and steady increase in effective demand of the population for quality food. The processes of globalization and steady increase in the consumption of food products all over the world also support opportunities to realize the potential of domestic producers in both domestic and foreign markets.

According to the moderately optimistic scenario one can predict full implementation by 2030 of progressive eco-humanistic model of the food sector, oriented to the needs of the population of Kazakhstan in high-quality and ecologically clean foods.

In general, moderately optimistic scenario assumes a high level of management, which allows to ensure the competitiveness of Kazakhstan in the food sector in the difficult conditions of globalization and adequately reflects the necessity of the organization of the unified system of reproductive management of food, which combines the strategic interests of the state, producers and final consumers of food products.

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