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# Scenarios for the Development of the Fruit and Vegetable Industry Using Econometric Modeling Methods

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A B S T R A C T
*Today, one of the urgent issues is the development of the system of production and sale of products in agriculture, ensuring mutual dependence. Also, the correct assessment of changes in the volume and price of manufactured products guarantees the mutual proportionality of not only the agricultural sector, but also all sectors of the economy. By correctly assessing the capacity of fruit and vegetable production and consumer markets, we will have the opportunity to assess the effectiveness of reforms in the agricultural sector. In the article, the factors influencing the volume of production of fruit and vegetable products are analyzed, and scientific opinions are given on future changes in several scenarios.*

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At present, "while the trade of fruit and vegetable products in the world market is more than 205 billion dollars, the share of our country is less than 1%. Therefore, in the next year, the export volume of our country's fruits and vegetables will reach 2.5 billion dollars, and in the next three years, this blind seller will increase to 5 billion dollars, as well as to cover the demand for food of the population of our country, and to increase the volume of exports. it is necessary to increase it by 8-10% per year and to grow more than 1 million tons of products"[1].

For this reason, in the "Concept of Agricultural Development until 2030" in our republic, as the main directions of continuing structural changes in agricultural production, complex mechanization of agriculture based on the introduction of innovative agro-technologies, increasing the production of finished consumer goods through deep processing of raw materials. Satisfying the needs of the population for food products at the expense of internal reserves and other promising measures are defined. In accordance with this, as mentioned before, in the process of structural reforms in agriculture, low-yielding and profitable cotton lands are freed, and these areas are gradually planted with high-yielding fruits and vegetables, potatoes, animal feed and other crops, as well as the establishment of intensive gardens, breeding and It is intended to solve the problems of seed production development.

Because, due to the worsening political and economic situation at the world level and other reasons, the World Health Organization and the World Trade Organization noted the need to take measures to prevent risks that may threaten global trade and food security. In addition, they predicted that uncertainty in food

[1]President of the Republic of Uzbekistan Sh.M. Mirziyoev's speech on November 5, 2019 at the meeting of the video selector on the issues of further development of the fruit and vegetable industry and increasing its export, ensuring the effective use of public land.

supply would create shortages in the world market, create export restrictions, change the balance of supply and demand for food products, and lead to sharp increases and volatility in prices. Accordingly in the present circumstances:

- firstly, due to periodic interruptions in the global food markets, strict restrictive measures imposed by the countries of the world began to have a negative effect on food supply chains;
- secondly, the growth of the "food shortage", in turn, the accumulation of exported food products, the weakening of the global supply system under the influence of protectionist policies and export subsidies used by some countries, according to some economists, the international trade and price of agricultural products significantly affects the system"[2];
- thirdly, "there is a lack of local seasonal labor resources in the agricultural sector, and for this reason, according to official statistics, the annual number of migrant workers employed in agriculture exceeds 200 million"[3].

Therefore, in conclusion, it should be noted that the aggravation of these and other risks on a global scale will lead to solving other problems such as free market mechanisms and the effective adaptation of the agricultural sector of Uzbekistan, especially the food industry, which is moving to a digital economy, to the increasingly complex conditions, and the development of a competitive national economy. requires the main focus. Therefore, in the future, it is important to research the methodological and methodological bases of assessing the development prospects of not only agriculture, but also other relevant non-industrial organizations and enterprises that are functionally related to it in terms of production and technology, and the impact of external economic factors that implement them.

In our opinion, V. Use of intersectoral balance methods developed by Leontev and his followers in the analysis of external economic factors of regional development[4], Determining the competitive advantages of regions and countries developed and justified in the research conducted by M. Porter[5] and determination of innovative factors of regional development through the method of evaluating the composition and dynamics of the gross regional product proposed by A.G. Granberg[6] the use of scientific-methodological approaches, among others, expands the possibility of predicting the development prospects of agriculture and its place in the international food market.

Based on the above-mentioned methodological approach and statistical data, in the course of the research, the dynamics of future changes in the volume of fruit and vegetable products in our republic were studied and relevant conclusions were drawn up. For example, it should be recognized that the natural and climatic conditions of our republic and the experience of farmers create great opportunities for the cultivation of high-quality and vitamin-rich fruit and vegetable products. Therefore, a steady growth trend is observed in the cultivation of almost all types of fruit and vegetable products, which is achieved due to the implementation of both the expansion of cultivated land (extensive) and the rational use of factors that ensure productivity growth (intensive).

For example, during the period of 2010-2022, when the structural reforms in this direction began, the land for vegetable cultivation increased by 13.5%, by 7.5% for cash crops, by 9% for fruits and berries (during the harvest period), and by 9% for grapes (during the harvest period) - increased by 9.8%. The change in the composition of arable land in the field of fruits and vegetables was primarily related to the reduction of cotton areas, that is, in exchange for reducing the production of cotton raw materials by 350 thousand tons, about 170.5 thousand hectares of irrigated fertile land were freed. During 2010-2022, the production of fruits and berries increased from 1676.3 to 2863.9 thousand tons (1.7 times), vegetables - from 6262.4 to 10459.5 thousand tons (1.7 times), grapes - from 979.0 By 1639.2 thousand tons (1.7 times), the

[2] Rayner A. J., Ingersent K. A., Hine R. C. Agriculture in the Uruguay Round: An Assessment // The Economic Journal. 1993. № 103. P.1513.

[3] https://www.wto.org, http://www.fao.org/in-action/ru

[4]Leontev V. Intersectoral economics. Per. English - M.: OJSC "Publishing house "Economy", 1997.

[5] Porter M. International competition /Per. s English, pod. ed. V.D. brush - M.: International relationships, 1993.

[6]Granberg A., Masakova I., Zaitseva Yu. Gross regional product as indicator differentiation of economic development of regions// Statistics questions, – 1998.- №9. - S.3-11.

volume increased from 1182.4 to 2134.3 thousand tons (1.8 times). 9.7 thousand ha in Uzbekistan since 2015. new intensive gardens and 9.2 thousand ha. vineyards were created on the ground.

In order to continue these structural reforms, the World Bank and the Government of Uzbekistan signed a loan agreement in the amount of 150 million US dollars through the International Bank for Reconstruction and Development to finance the project for the development of the fruit and vegetable industry. The project is being implemented in Andijan, Jizzakh, Kashkadarya, Namangan, Samarkand, Fergana, Tashkent regions and the Republic of Karakalpakstan on a total of 1000 hectares of land. As part of this project:

- Ensuring the growth and diversity of agricultural products, doubling the volume of fruit and vegetable and animal husbandry production, and establishing 55 districts, 86 clusters and 125 cooperatives specializing in fruit and vegetable production;
- Effective use of private plots of farmers and homestead landowners, providing them with high-yielding and profitable crop varieties, preventing fruit and vegetable spoilage;
- To increase the volume of export of agricultural products, to ensure the competitiveness of Uzbek fruit and vegetable products in the world markets today and in the future, to bring them to a level that meets consumer tastes and brand standards. At this point, it is worth noting that this type of products are currently exported to 66 countries of the world, Uzbekistan ranks 10th in the world ranking for the export of apricots, plums, grapes, walnuts, cabbage and a number of other fruit and vegetable products.

In particular, the export of food products will increase to 3.5 billion in 2021. US dollars, 10 billion by 2025. US dollars. and 20 billion by 2030. It is planned to deliver to US dollars. "To achieve this, it is necessary to choose crops and varieties correctly, to increase productivity and income by at least two to three times, to prevent wastage, to store products, to properly organize logistics issues and export"[7]. Today, the exporters of our country are being facilitated in every way to carry out these tasks. In particular, the application of fines to overdue receivables in foreign trade operations will be stopped at the expense of the funds allocated to the Agency for Export Assistance under the Ministry of Investment and Foreign Trade, and it is planned to cover 50% of the transportation costs of fruit and vegetable products. In addition, an additional 50 billion will be allocated to support this Fund. Soums of funds have been allocated, speedy passage of goods through border customs posts, processing of documents, as well as issuance of permits for export and import goods have been simplified.

In increasing the volume of production and export of fruits and vegetables and other food products, as mentioned above, financial and technological support of farmers and landowners who provide more than 70% of these products in the current conditions will in the future improve the export performance of the country's agriculture. It should be noted that it is important in increasing the quality. According to the analysis, as a result of targeted organizational and economic reforms implemented in the agricultural sector, the share of farmers and homestead landowners in the production of fruit and vegetable products tends to increase from year to year (Figure 3.5).

[7] President of the Republic of Uzbekistan Sh.M. Mirziyoev's speech on November 5, 2019 at the meeting of the video selector on the issues of further development of the fruit and vegetable industry and increasing its export, ensuring the effective use of public land. http://uza.uz/oz/politics/meva-sabzavotchilikni-yanada-rivozhlandani-va-eksportini-o-05-11-2019

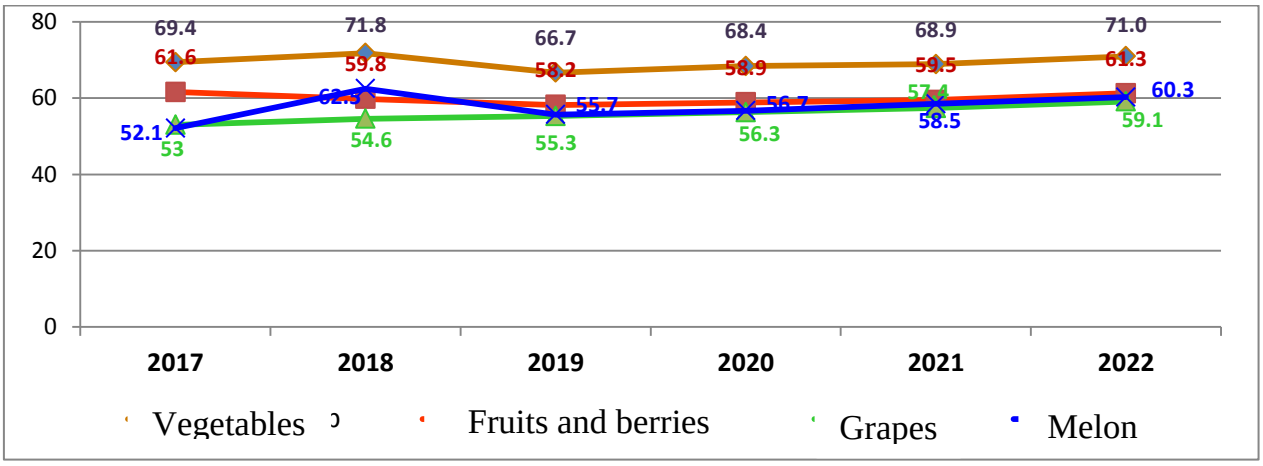


**Figure 3.5. Changes in the share of the republic's peasant farms and homestead land owners in the cultivation of fruit and vegetable products in 2017-2022[8]**

Therefore, the share of these economic subjects in the production of vegetable products will increase from 69.4% in 2017 to 71.0% in 2022, respectively, fruits and berries will increase from 61.6% to 61.3%, grapes will increase from 53.08% to 59.1%. % and polys crops changed from 52.1% to 60.3%. Due to this growth, the production of agricultural products will increase to 16.7 million in 2021. 25 million per ton in 2025. tons is planned. As a result, the per capita production of fruits and vegetables has a steady growth trend, which indicates that these indicators are close to the consumption standards recommended by the Ministry of Health of the Republic of Uzbekistan (Figure 3.6).

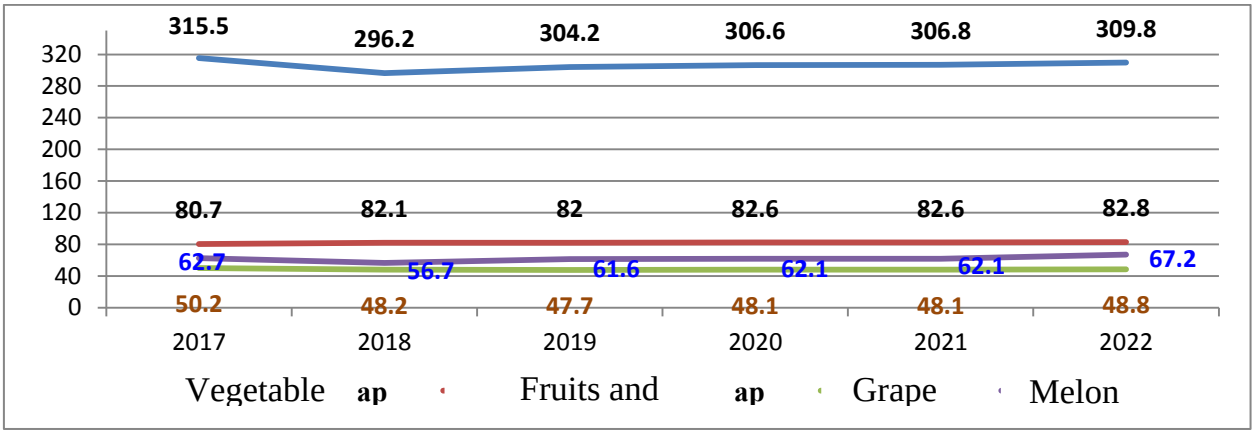


**Figure 3.6. Dynamics of fruit and vegetable products grown per capita in the Republic of Uzbekistan[9]**

Nevertheless, in our opinion, in order to further increase the export potential of these industries, to develop a perspective development strategy, the optimal placement of crops between regions and diversification of the development activities of economic entities, the development and implementation of deep specialization measures are recognized as the next important directions. and should be resolved. In this regard, it can be concluded that the structural changes carried out to ensure the competitive advantages and priority of the regions are bearing fruit. For example, Bulung'ur and Ko'shrabod districts of Samarkand region specialized in grapes and processed consumer goods, Parkent district of Tashkent region specialized in freshly picked grapes, Shahrisabz and Kitob districts of Kashkadarya region in fruit and grapes, Toragorgon district of Namangan region specialized in production and sale of cherries and dried fruits.

In general, it should be noted that the fruit and vegetable industry in the republic is developing within the framework of the demand for grapes, fruits and vegetables of the local population and foreign markets due to the organizational and economic support of economic entities by the state. For example, in 2022, compared to 2017, the total export volume of agricultural products increased by 2.3 times. Therefore,

[8] It was calculated based on the information of the State Statistics Committee of the Republic of Uzbekistan
[9] It was developed by the author based on the information of the State Statistics Committee of Uzbekistan.

sufficient saturation of the domestic market, in turn, serves to further increase the export potential of the industry and expand its geography. In our opinion, the following directions and mechanisms of state support for export-oriented production of fruits and vegetables play an important role in this. Including:

- Reimbursement of 50% of the costs of product delivery by road and air transport to exporters ensured their financial stability. Since before, only export goods were subsidized by railway, and this means of transport was rarely used in small volumes, so it was not an effective measure;
- The Export Promotion Agency under the Ministry of Investment and Foreign Trade covers the insurance premium if the exporter uses the insurance amount as collateral, and this is an effective mechanism for financial security in the delivery of products;
- The cancellation of mandatory payments to legal entities and the verification of debts on executive documents in the process of customs documents for export goods applies to individuals, in which export processes are accelerated and simplified[10].

However, in our opinion, in the current conditions of our republic, it is urgent to develop forecasts for the future development of this industry, taking into account the trends in the production and export of fruit and vegetable products and the demand in foreign markets. In the study, the following indicators were selected in the correlation-regression model developed using the database of the volume of fruit and vegetable products of the State Statistics Committee of the Republic of Uzbekistan for 2015-2022: Y - total export volume, thousand tons; $X_1$ – product produced per capita, kg; $X_2$ - productivity level, ts/ha.; $X_3$ - total cultivated area, thousand ha (Table 3.2). From Table 3.2, we can see that in recent years, along with the significant increase in production volume and productivity, the cultivated area has also expanded.

**Table 3.2. The main indicators of production of fruit and vegetable products**

| Years | Export | Product per capita (kg) | Productivity, ts/ha | Crop area |
|---|---|---|---|---|
| **Vegetable products** | | | | |
| 2015 | 291,5 | 300 | 271,0 | 194046 |
| 2016 | 351,7 | 306,75 | 271,1 | 205960 |
| 2017 | 373,8 | 313,5 | 254 | 189696 |
| 2018 | 688,5 | 315,9 | 237 | 219037 |
| 2019 | 811,4 | 318,61 | 236 | 219953 |
| 2020 | 782,1 | 319,9 | 246 | 224207 |
| 2021 | 1311,3 | 321,63 | 270,6 | 233532 |
| 2022 | 1324,4 | 326,34 | 292,2 | 351059 |
| **Grape product** | | | | |
| 2015 | 84,9 | 49,13 | 133,1 | 128311 |
| 2016 | 96,2 | 50,92 | 142,3 | 131173 |
| 2017 | 111,9 | 50,97 | 143,7 | 114540 |
| 2018 | 130,1 | 50,98 | 146,3 | 113253 |
| 2019 | 160,17 | 51,49 | 149,5 | 120176 |
| 2020 | 140,5 | 52,57 | 150,0 | 125957 |
| 2021 | 229,9 | 52,94 | 150,8 | 133730 |
| 2022 | 244 | 53,36 | 150 | 181893 |

Because the arable areas with low yield and low soil quality are cleared of cotton and grain and are specialized for export fruits and vegetables and viticulture.

In particular, the calculations show that there was no strong correlation between all factors and the resulting factor, and the coefficient of determination in vegetable growing was equal to R2=0.85, while in the export of cultivated grape products, this indicator was equal to R2=0.83, that is, the growth of the

[10] Decision PQ-4707 of the President of the Republic of Uzbekistan dated May 7, 2020 "On measures to further support export activities".

export volume was influenced by the selected factors. the probability of impact is on average 85 and 83 percent.

**Table 3.3 Correlation matrix representing the interrelationship of the result indicator and factors of fruit and vegetable production [11]**

| Factors | Vegetables | | | |
|---|---|---|---|---|
| | Y | $X_1$ | $X_2$ | $X_3$ |
| **Y** | 1.0000 | | | |
| $X_1$ | 0,8792 | 1.0000 | | |
| $X_2$ | 0,2975 | 0,0103 | 1.0000 | |
| $X_3$ | 0,7692 | 0,6955 | 0,5773 | 1.0000 |
| | **Узум** | | | |
| | Y | $X_1$ | $X_2$ | $X_3$ |
| **Y** | 1.0000 | | | |
| $X_1$ | 0.8748 | 1.0000 | | |
| $X_2$ | 0.7569 | 0.9108 | 1.0000 | |
| $X_3$ | 0.6750 | 0.5612 | 0.2460 | 1.0000 |

As a result of analyzing the data of Table 3.2, the following regression analysis was obtained (Table 3.4).

**Table 3.4. Coefficients of regression statistics [12]**

| Factors | Coefficients | Standard error | t | p>(t) | Interval |
|---|---|---|---|---|---|
| **Exporting vegetables** | | | | | |
| $X_1$ | 43,2376 | 16,9799 | 2,55 | 0,064 | 90,3816 |
| $X_2$ | 6,3515 | 6,4032 | 0,99 | 0,377 | 24,1296 |
| $X_3$ | -0.0028 | 0,0034 | -0,08 | 0,939 | 0,0092 |
| **const** | -14476,7 | 58,9037 | -2,46 | 0,070 | 18,77 |
| When exporting grapes | | | | | |
| $X_1$ | 8,6992 | 39,98 | 0,22 | 0,838 | 119,7 |
| $X_2$ | 4,5503 | 7,8047 | 0,58 | 0,591 | 26,21 |
| $X_3$ | 0,0012 | 0,001 | 1,13 | 0,321 | 0,0041 |
| **const** | -1120,56 | 87,9 | -1,25 | 0,280 | 13,71 |

So, based on regression statistical coefficients, the linear model for the export of vegetable and grape products is as follows:

1. A linear regression model for vegetables;

$$У = -14476,7 + 43,23x_1 + 6,35x_2 - 0,001x_3, \textbf{ (3.4)}$$

2. Grapevine's linear regression model;

$$У = -1120,5 + 8,69x_1 + 4,55x_2 + 0,0012x_3, \textbf{ (3.5)}$$

The calculation of the parameters of the forecast until 2030 for increasing the volume of export of vegetable and grape products in the republic was mainly based on 3 (3-year, 5-year and 8-year) scenarios. In the first 3 years, factors such as the use of technical factors (new technologies, resource-saving techniques) introduced into production, scientific achievements used in increasing productivity in the 5th year, and improvement of pest control are taken into account. At the same time, the parameters of the 8-year forecast include long-term factors such as the creation of more new varieties, the increase in intensive orchards.

The factor that has the greatest impact on the growth of vegetable export volume is the increase of

[11] Author's calculations based on the information of the State Statistics Committee of Uzbekistan.

[12] Author's calculations based on the information of the State Statistics Committee of Uzbekistan

manufactured products per capita, that is, the increase of manufactured products by one unit ensures a sharp increase in the export volume. Only, there is a small inverse correlation with exports in the increase of cultivated area, where it is more desirable to provide seeds for higher productivity than to increase the size of cultivated area. At the same time, we can see that the increase in production per capita has the greatest effect on the export volume of grapes.

From the obtained results, we can see that in the first 3 years, the forecast indicators for the cultivation and export of grape products are expected to increase by 16%, although the data analyzed above includes cultivated areas, but the increase in the volume of new vineyards has been observed relatively little. Production is being intensified due to the expected growth of productivity in the next years, the study of the experiences of foreign countries and the increase of new fertile vineyards.

**Table 3.5. Forecast parameters of the volume of production of vegetable and grape products in the Republic of Uzbekistan until 2030** [13]

| Years | Total production volume, thousand tons | export, thousand tons | Cultivated area, ha |
|---|---|---|---|
| **By grape product** | | | |
| **2023** | 1767,0 | 251,4 | 154113 |
| **2024** | 1819,0 | 273,98 | 159220,5 |
| **2025** | 1870,0 | 296,5 | 160328,1 |
| **2026** | 1920,0 | 319,1 | 162435,6 |
| **2027** | 1972,0 | 341,7 | 163543,1 |
| **2028** | 2023,0 | 364,4 | 165650,7 |
| **2029** | 2072,0 | 386,9 | 166758,2 |
| **2030** | 2122,0 | 409,6 | 168865,7 |
| On vegetable products | | | |
| **2023** | 11799,7 | 1458,41 | 301547 |
| **2024** | 12271,7 | 1617,6 | 310516 |
| **2025** | 12738,0 | 1776,9 | 323485,1 |
| **2026** | 13120,1 | 1936,1 | 329454,1 |
| **2027** | 13382,5 | 2095,4 | 335423,2 |
| **2028** | 13770,6 | 2254,6 | 345392,2 |
| **2029** | 14360,0 | 2413,9 | 348361,3 |
| **2030** | 14934,4 | 2573,1 | 352330,3 |

While the growth of vegetable export volume is expected to increase by 18% in the initial period of 2023-2025, in the next medium-term period, by 2027, the volume of vegetable export is expected to increase by almost 50% compared to 2023. Of course, in this process, there is a need to enter new markets and study their requirements. For this reason, in the future, there is a demand to expand export markets and produce products according to international standard requirements. Also, in the graphs above, the growth of the export volume was calculated with all factors unchanged, and with the largest and smallest probabilities. According to the analysis, the export volume of vegetables is expected to be at least 60% higher than the results of 2023.

Therefore, in the course of this research, we believe that it is appropriate to present the following analysis results based on the comparison of the forecast parameters for the cultivation of vegetables, fruit and grape products until 2030 with the forecast volumes approved by the above decision. In particular, the forecasted volume of vegetable products in the decision, for example, 12192.3 thousand tons for 2023, while our calculations recorded 11799.7 thousand tons, so the difference was 392.6 thousand tons or more than 3.2 percent. Also, the levels of this difference were equal to 65.8 thousand tons (2.1%) and 181.4 thousand tons (9.3%) for fruit and grape products, respectively. It is known that in the field of science, if the error index of the results obtained in one or another direction is up to 7%, they are considered methodologically reasonable.

[13] Муаллиф тадқиқотлари асосида тузилган.

In our opinion, the origin of these differences in the practice of statistics in many cases, firstly, the fact that the data used in the research process is partially inconsistent with the actual ones, secondly, there is a practice of making some changes to statistical data at the state level, and thirdly, the level of reliability of the data provided by the regional statistical offices.

Therefore, we believe that the use of the system of finally approved statistical indicators in the evaluation of the parameters of prospects for the development of economic sectors and sectors in research, in cases where their authenticity is ensured through modern analysis methods based on digital technologies, creates a basis for obtaining real results.

From these aspects, in our opinion, through the development of information and communication networks and marketing and advertising services, it is possible to increase the export volume of products (goods, services) to the markets of the world countries, mutual production-economic relations between the fruit and vegetable industry, organizations and enterprises of the related sector, and The development of state programs, measures and investment projects aimed at the further development of the processes of transformation of international trade relations on the basis of digital technologies, their consistent and effective implementation in practice will serve as the basis for improving the directions and mechanisms of the digital economy in the future in accordance with the conditions of globalization of the world economy..

**Conclude.** Global climate change and the expansion of the scale of interstate economic and trade relations and the tendency of product (goods) exchange systems to become more complex, in turn, a unified database of all specialized markets that exist and operate worldwide, and analysis of their movements and changes at the international level, making forward-looking decisions intensive implementation and development of digital economy mechanisms and information and communication technologies to solve tasks is an objective necessity.

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