

FOREIGN EXPERIENCES ON INCREASING THE EFFICIENCY OF GREENHOUSE FARMS AND OPPORTUNITIES FOR THEIR USE

A.Sh.Durmanov, PhD, associate professor, National Research University “Tashkent Institute of Irrigation and Agricultural Mechanization Engineers”

Abstract

In this article, a comparative description of greenhouses in the leading countries and the Republic of Uzbekistan, the area of greenhouses in the leading countries and the Republic of Uzbekistan, indicators of competitiveness of vegetable products grown in greenhouses in the international market, indicators of competitiveness of countries in the international vegetable market, criteria for an integrated assessment of the level of competitiveness of vegetables grown in greenhouses in the international market, and international indicators of countries for vegetables a strategy for estimating matrix prices in the market is proposed.

Keywords : **international vegetable market, greenhouse, integrated evaluation criteria, price evaluation strategy**

Introduction. In recent years, the area of protected land in the world has increased by 24%. As of January 1, 2019, the area of greenhouses in the world is 497.8 thousand hectares. 90% of this area is provided with plastic greenhouses and 10% with glass greenhouses. According to experts, the area of greenhouses will increase by 11% per year and will reach 750,000 hectares by 2021.

It should be noted that Europe is considered the leader in the field of greenhouses and has 210,000 hectares of greenhouses (42.2%). In Asia - 180.5 thousand (36.3), Africa - 45.3 thousand (9.1), North America - 31.8 thousand (6.4), Middle East - 14.6 thousand ha (2.9%), South America - 14 thousand ha (2.8%) and Oceania - 1.6 thousand ha (0.3%) of the land area have greenhouses [1].

International experience shows that 70% of grown vegetables are sold fresh, 5-10% are sent for processing, and 20-25% are wasted or fed to livestock. However, the proportion of packaged and bulk vegetables varies from country to country. For example, about 85% of packaged vegetables are sold in Germany, 55% in England, 45% in Australia and 25% in Russia. In countries such as Mexico, Brazil, India and China, this figure is less than 2 percent [2].

Also, due to the development of the greenhouse industry, there is a tendency to increase the volume of production. This was achieved due to the introduction of intensive technologies, the expansion of methods of growing plants in greenhouses, new designs, eco-technologies, and the use of energy-saving technologies. Wide introduction of new developments and technologies in the cultivation of vegetable products in greenhouses is aimed at rational use and saving of available resources. This, in turn, leads to a decrease in production costs, including a decrease in the cost of products.

Materials and methods. The main goal of the article is to analyze foreign experiences and opportunities to use them to improve the efficiency of greenhouse farms. In order to achieve the goal, the following tasks were set. Including: a comparative description of greenhouses in the leading countries and the Republic of Uzbekistan, the area of greenhouses in the leading countries and the Republic of Uzbekistan, indicators of competitiveness of vegetable products grown in greenhouses in the international market, indicators of competitiveness of countries in the international vegetable market, criteria for an integrated assessment of the level of competitiveness of vegetables grown in greenhouses in the international market, and international indicators of countries for vegetables a strategy for estimating matrix prices in the market is

proposed.

Results, analysis and discussion. Israel's innovation, including full control of many technological parameters in greenhouses, allows for maximum use of space and optimal distribution of production during the agricultural season. As a result, farmers get 300 tons of tomatoes per hectare in one season, which is four times more than in open fields (Table 1).

Table 1.

Country	Advantages	Resource saving technologies	Technologies used	State support
China	The largest number of greenhouses (80% of the global area). The first place in the world for the production of mushrooms in the greenhouse	Placement of greenhouses in the southwestern part of the country	Intensive land use	Granting subsidies to the agricultural sector in the amount of 8.5% of the value of the products produced
Netherlands	One of the leading places in the world in terms of protected land area and the number of greenhouse products per 1 person	High utilization of greenhouse areas throughout the year regardless of weather conditions	Specialization of farms on a limited number of cheap products, the presence of a large number of greenhouses, and they are harvested several times a year. Labor productivity "re-grouping" is carried out in the field of trucks based on high and economic efficiency	A long term loan program for farmers with an interest rate of 1.3-2.5% for a period of up to 25 years
Japan	Leading vegetable consumption per capita (large domestic market)	Vinyl film (saving 20% heat consumption compared to polyethylene coating used in Europe); use of renewable energy sources (geothermal waters and sunlight); the use of multi-layer coatings for the greenhouse (20-40% savings); heat pumps, air conditioners, heating in cold and cooling in hot, using automated control over microclimate parameters	Solid acrylic coatings, service life 7 years. Special plant factories: small (60-80 m ²), fully automated hydroponic stations equipped with year-round artificial lighting, computer control, and rotary conveyor systems for adjustment. This system does not depend on weather conditions, the time for planting crops is 2-4 times less, the yield is 21 times higher than in open	The construction of greenhouses is supported by the state. Pays 88% of agricultural production to support consumer prices

Israel	Climatic conditions, diverse topographical and climatic conditions	Climate control systems and low volume artificial substrata. For example, low-volume technology allows obtaining 500 tons of tomatoes per 1 hectare, and in the open field 80 t per ha. A modern greenhouse allows full control of many technological parameters, as well as maximum use of areas and optimal distribution of crop production during the agricultural season.	ground, the products are of higher quality and lower nitrate than vegetables grown in traditional greenhouses in the same season. Drip irrigation affects the growth of plants through photosynthesis, film, special fly nets that work during the adjustment of the light spectrum and ventilation and reduce the need for chemical treatment in response to sunlight, heat protection screens and sunlight intensity. As a result, production will increase significantly. Farmers get 300 tons of tomatoes per hectare in one season, which is four times more than open fields.	If a greenhouse equipped with modern technologies is built, the farmer, whose price is half a million dollars, will receive compensation from the national budget in the amount of 30% of the settlement, or pay 30% of the loan taken for construction.
Uzbekistan	Climatic conditions, the area of land intended for agriculture is large	Placement of greenhouses in favorable climatic conditions. Water saving technology	Measures adopted by the state to increase the area of intensive gardens and greenhouses using modern resource saving technologies, including drip and sprinkler irrigation	An advance amount of not less than 20 percent of the value of the leased object is paid to the lessee. Interest rates up to 7 years 4-5-20% in US dollars, 9-10% in soums. Exempt from VAT, customs and other mandatory fees.

Developed by the author.

According to experts, today the Netherlands is a technological leader in growing vegetables in greenhouses. This country has been and remains a world leader in the introduction and use of greenhouse technologies. China has the largest greenhouse economy among other countries and Japan has the largest domestic market, which increases the demand for greenhouse products and thus develops it. Another important detail is that greenhouses in leading countries are strongly supported by the state.

As for Uzbekistan, it has a good climate, but in terms of technology it is far behind the world leaders. According to previous estimates, much attention is paid to water- and energy-saving technologies, which significantly reduce the cost of production and reduce the cost of production even below the national level. In addition, the greenhouse industry is now developing with state support.

In particular, in order to develop this industry in our country, the Decree of the President of the Republic of Uzbekistan dated March 20, 2019 "On measures to further develop horticulture and greenhouses in the Republic of Uzbekistan" was adopted. Based on this decree, the Agency for Horticulture and Greenhouse Development was established under the Ministry of Agriculture of the Republic of Uzbekistan. The agency established a non-legal entity horticulture and greenhouse development fund. Its funds are used to implement complex target programs aimed at the sustainable development of horticulture and greenhouses. At the same time, state support for newly established gardens and greenhouses that have introduced water-saving irrigation technologies based on drip and sprinkler irrigation is provided in the form of subsidies from the Fund and the state budget [3].

Also, the State Fund for Entrepreneurship Development under the Cabinet of Ministers of the Republic of Uzbekistan provides guarantees for the establishment of intensive gardens and greenhouses up to 50%, taking into account the amount of loans received from commercial banks, not exceeding 5 billion soums.

At a time when the whole world is moving from open field farming to greenhouse farming, new technologies

are entering greenhouses in Uzbekistan. This will help the rapid development of this industry. Investments in the construction of new energy-efficient greenhouses are attracted to this by private investors as an effective way of profiting.

Although the area of protected land in developed countries is much higher than in the territory of Uzbekistan, the republic is among the top ten in terms of the area of greenhouses (Table 2).

Table 2. Area of greenhouses in leading countries and the Republic of Uzbekistan (2019) [4]

Country	Area of greenhouses (hectares)	Hectares per 1000 people
China	1700000	1.271
Spain	52000	1.131
Japan	42000	0.33
Turkey	41000	0.565
Italy	20000	0.331
Netherlands	13000	0.782
Morocco	10000	0.314
France	8500	0.13
Uzbekistan	7175	0.243
Paul sha	6300	0.163
Israel	3000	0.396

Although the area of greenhouses in Uzbekistan is twice that of Israel, it lags significantly behind in terms of export volume. In Uzbekistan, greenhouse area is 0.243 per 1000 people. In these greenhouses, the yield was 3-10 kg/m², while in developed countries this indicator is equal to 50-60 kg/m². To achieve this result, it is appropriate to introduce innovative developments to existing greenhouses in our country.

As can be seen from the data in Table 2, there are 31,297 greenhouses in Uzbekistan with a total area of 7,175 hectares. Since many regions of the Republic of Uzbekistan have a favorable climate, the location of greenhouses allows saving more resources due to the decrease in the cost of lighting. Experiences of market leaders confirm that results can be achieved thanks to new technologies and without increasing the space.

In the Republic of Uzbekistan, special attention is paid to the cultivation and processing of fruits and vegetables, as well as to the wide introduction and development of greenhouses in the field of fruit and vegetable production. Taking into account limited land plots in Uzbekistan, the production of vegetable products in greenhouses is accelerating due to the expansion of other agricultural activities with high added value.

The main problems of exporting vegetables grown in greenhouses are the inefficiency of the marketing strategy and the lack of diversification of marketing markets, which creates a number of potential risks. First, the instability of the economic situation and the decrease in the demand for fruits and vegetables in the main importing countries can cause serious problems for the agro-industry. Secondly, the monopsony power of the importing countries can create an opportunity for buyers-importers to determine the price of fruit and vegetable products in Uzbekistan.

The indicator of vegetable export volumes of the Republic of Uzbekistan, expressed in millions of US dollars, was used as a dependent variable (Y). Indicators that directly affect export volumes were considered as independent variables (economic factors) [6], [7], [8]: the vegetable production output in the Republic of Uzbekistan (X1); the level of domestic prices for vegetables (X2); the level of world prices for vegetables (X3); yielding capacity (X4); yielding capacity per capita (X5); planting acreage (X6); the volume of domestic trade (X7); investment in the industry (X8); cost of

production (X9); the level of supplying the domestic demand for products in (X10) calculated as the ratio of production volumes to consumption volumes; the level of external demand for products (X11). The data array was formed by standardized values of indicators Y and X1-X11 for Uzbekistan for 2010-2020 aggregated annually (the time series was seven observations).

Based on the experiences of foreign experts, the competitiveness of vegetable products grown in greenhouses in foreign countries and Uzbekistan in the international market was determined. According to it, the level of influence of competitiveness on production volume (X1, priority value 0.02), production value (X9, 0.05), level of satisfaction of product demand in the domestic market (X10, 0.21), climatic conditions (X12, 0.27), the geopolitical situation (X13, 0.09), and the level of trade liberalization (X14, 0.36) were determined by such factors (Table 3).

Table 3.
Vegetable products grown in greenhouses indicators of competitiveness in the international market

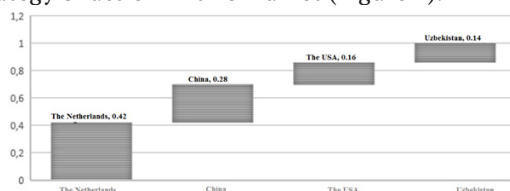
Name of countries	Indicator			
	X1	X9	X10	X12
Netherlands	0,02	0,54	0,62	0,22
China	0,86	0,14	0,08	0,24
USA	0,1	0,27	0,09	0,27
Uzbekistan	0,02	0,05	0,21	0,27

The calculation is based on the author's research.

Volume of production of vegetable products, the greenhouses of Uzbekistan are much lower than those of industrialized countries. Its volume is 43 times that of China, 5 times smaller than that of the United States, and is on par with the Netherlands.

In terms of price, the highest competitiveness is in the Netherlands, and Uzbekistan has the lowest competitiveness according to this criterion. The remote cost also includes the costs associated with maintaining the appropriate climate conditions, but this factor has been taken into account in the evaluation according to criterion X12. A negative trade balance of vegetables was observed in China and the USA. This means that domestic demand is not fully met by domestic producers, despite the fact that the volume of production and export is significantly higher. Sales revenue is high in the Netherlands, which means meeting domestic demand.

According to the criteria of competitiveness indicators in the foreign market, the main problem of the trade of vegetables grown in the greenhouses of our country is the low level of product export and diversification. The price level of vegetables sold in the market is mainly oriented towards profit. Prices determine the attractiveness of the market. Depending on the price and competitive advantages of greenhouses, it is appropriate to develop a strategy of action in this market (Figure 1).



The calculation is based on the author's research.
Figure 1. Competitive indicators of countries in the international vegetable market (2019).

As can be seen from the picture, when evaluating the competitiveness of the international vegetable market, according to the integrated evaluation, Uzbekistan occupies the indicator - 0.14. In the Netherlands, the level of competitiveness in the sales market is high, which is equal to 0.42.

Based on the integrated indicator, the quantitative and qualitative aspects of evaluating the competitiveness of countries in the international market for vegetables were determined (Table 4).

Table 4.
Criterion of integrated evaluation of competitiveness level of vegetables grown in the greenhouse in the international market

Quality indicators	K' indicator level
Low	[0; 0,16)
Average	[0,16; 0,26)
High	[0,26; 1]

As can be seen from the table, the level of competitiveness of vegetable products grown in greenhouses in the international market is "low" (0-0.16), "average" (0.16-0.26) and "high" (0.26-1) through the integrated assessment criteria is evaluated.

The price level is determined by the price index. The stable price level corresponds to the value of 1 of the index and its confidence interval, allowing a 5 percent error [0.95; 1.05], taking into account the deflation - [0; 0.95], inflation will be equal to - (1.05; +∞).

The matrix constructed in this way provides an opportunity to take into account the current market conditions, export volume, potential and the main objective of the greenhouse vegetable market is to increase the income. According to the matrix pricing strategy of countries in the international market for vegetables, China and the Netherlands are leading countries and have strategies to penetrate domestic and international markets for vegetable products. Also, in this direction, these countries started their activities based on the strategy of high income (Figure 2).



Developed by the author.
Figure 2. International market of countries for vegetables matrix pricing strategy

In the conditions of modernization of the economy, the main factors determining the competitiveness of greenhouses in Uzbekistan are the following: volume of production of vegetable products; production costs; level of satisfaction of product demand in the domestic market; climatic conditions; is the country's geopolitical situation and degree of trade liberalization. One of the main reasons for the low level of competitiveness of Uzbekistan's

greenhouse vegetable growing in the international market is the high cost of growing and processing vegetables.

The matrix of the pricing strategy of greenhouse vegetables in the export market is characterized by the low level of competitiveness of greenhouse farms in Uzbekistan today. According to scientists, the main risks of greenhouse farms in the international vegetable market as a result of the formation of marketing strategies in our country are unstable profitability of vegetable export, increase in export volume, poorly organized logistics, lack of stable markets, etc. It is necessary to improve the marketing strategy in order to develop the trade of vegetables grown in greenhouses in Uzbekistan in international markets. First of all, special attention should be paid to diversifying the supply of quality products that meet the standards of the European Union, Japan, Korea and China. Because these countries are characterized by high purchasing power. Therefore, the state should support the organization and development of specialized organizations that supply vegetables grown in greenhouses, dried and processed products to countries with high purchasing power.

Special attention should be paid to optimizing the cost of growing, processing, storing and supplying vegetables. First, it is necessary to ensure the targeted orientation of greenhouse farming to the use of coal to ensure that vegetables become cheaper by 36 percent. National transport companies are recommended to optimize the logistics system for the delivery of fruits and vegetables to the international market by establishing their own large transport fleet and multimodal transport services.

Thus, the developed matrix of the pricing strategy in the international trade market made it possible to take into account the main goal of Uzbekistan's greenhouses, taking into account the country's export potential and earning potential. In this case, it is necessary to introduce incentives depending on the export volume, to simplify the process of concluding export contracts, to introduce a mechanism for assessing the customs value of vegetable products and its certification.

According to the results of the research, to develop the markets for the sale of greenhouse products in

Uzbekistan, it is necessary to increase the export of vegetables, that is, the supply of products to countries with a high level of consumption. In order to ensure the competitiveness of vegetables grown in greenhouses in the international market, it is necessary to establish production, storage and processing of products based on requirements. This, in turn, leads to a steady development of the level of competitiveness (integral index value [0, 0.16]) of greenhouses in selling vegetable products on the international market in the main exporting countries, such as the USA, the Netherlands, and China. In order to effectively organize the sale of vegetables grown in greenhouses in international markets, it is advisable to develop marketing and logistics systems of production and delivery of products, and to export diversified products to Europe, China, Korea and Japan.

Conclusion. Also, our country has important resources such as favorable climate conditions and protected lands that serve to develop an alternative climate. Therefore, using innovative hydroponics can improve the situation by saving resources, reducing production costs and stabilizing production. It is important to use innovations aimed at saving energy sources, because today they account for 50% of the cost of production. This is the priority direction of introducing innovations to the greenhouses of the Republic of Uzbekistan. The introduction of fifth-generation greenhouses in our country will help to save 92672300 US dollars annually. In addition, reduction of energy tariffs in agriculture as a result of state support also helps to save energy. All this, along with an increase in the volume of exports, reduces the import of vegetable products and in turn ensures the country's food security. The experience of the world leaders in the field of greenhouse management shows that there are limited areas and not always a favorable climate, but with the help of innovative technologies, it is possible to save various resources necessary for growing products in large quantities and managing smart greenhouses.

References:

1. Decree of the President of the Republic of Uzbekistan dated March 20, 2019 "On measures to further develop horticulture and greenhouses in the Republic of Uzbekistan" i. - www.lex.uz.
2. Makarenko O. Teplichnaya sverkhderjava, nalog na domashnih jivotnyx i rost sprosa na navoz. - Sieve. magazine, Mirovoe obozrenie. - <https://oko-planet.su>
3. Medvedeva A. _ (2018) Mirovye i rossiyskie perspektivy teplichnogo ovoshchevodstva. APK NEWS , 7 (1): 35-37 , <https://www.elibrary.ru/item.asp?id=35330779> ;
4. Durmanov, A. et al. (2021). Development of the Organizational and Economic Mechanisms of Greenhouse Industry in the Republic of Uzbekistan. Journal of Environmental Management and Tourism, (Volume XII, Spring), 2(50): 331 - 340. DOI: 10.14505/jemt.v12.2(50).03
5. Saipov Z., Arifdjanov G. Selskoe hozyaystvo ukhodit pod kryshu. - J.: Ekonomicheskoe obozrenie, 2019. - No. 5 (233). - <https://review.uz/post/selskoe-khozyaystvo-ukhodit-pod-kryshu>
6. Daruich, D., Easterly, W., & Reshef, A., "The surprising instability of export specializations", Journal of Development Economics, Vol 137, pp. 36-65, 2019.
7. Dohse, D., & Niebuhr, A., "How different kinds of innovation affect exporting", Economics Letters, Vol 163, pp. 182-185, 2018
8. Yang, X., Cai, G., Chen, Y.-J., & Yang, S.-J.S., "Competitive Retailer Strategies for New Market Research, Entry and Positioning Decisions", Journal of Retailing, Vol 93, No 2, pp. 172-186, 2017