



FORECASTING THE VEGETABLES CONSUMPTION OF UZBEKISTAN

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Article history:	Abstract:
Received: 11 th December 2022 Accepted: 10 th January 2023 Published: 20 th February 2023	The main development trends in the vegetable market of the world countries are studied in the article. In Uzbekistan, it has been determined that the population should increase their consumption of vegetables. Trend models were obtained based on the SPSS Statistical software package on changes in the consumption of vegetables by the Uzbekistan population. Based on the obtained trend models, the population consumption of vegetables until 2026 is forecasted.

Keywords: vegetables, consumption, food security, marketing, forecast, trend models..

1. INTRODUCTION.

The main problem in the consumption of vegetables in the countries of the world is related to the fact that farmers use pesticides in large quantities to increase productivity, and consumers suffer from it. If customers consume large amounts of such vegetables, their health may be adversely affected. Because of this, there is a trend of consumers switching from eating non-organic food to organic vegetables. There are also cases in Uzbekistan. While farms and quality, standardization and metrology services are functioning, in recent years, the number of cases of poisoning from vegetables and various hereditary diseases through their constant consumption has been increasing in Uzbekistan. This is due to the fact that there is no sufficient control of the relevant official organizations, there are many attempts to falsify the established standards in production and sales. In general, farmers' markets do not have sufficient material and technical support for inspection of all products by sanitary and epidemiological control bodies. From this point of view, it is important to develop strategic directions for increasing the consumption of quality and organic vegetables.[17]

2. LITERATURE REVIEW

In recent years, people are paying more attention to their healthy lifestyle. In Uzbekistan, food safety is a constant focus of consumers. For example, common processed foods contain many chemicals that cause health problems. In addition, agricultural products that people consume directly are sometimes not processed. Agro-ecological external environment, such as water resources, air pollution, also has a negative effect on the quality of vegetable products. [16] People who unknowingly consume these products for long periods of time have negative effects on their own health and the health of future generations, such as chronic

diseases and delayed fetal development. Food security is a common problem for people all over the world.[1]

Recent studies conducted by foreign scientists are examining trends in health, sustainability, authenticity, and convenience as key factors in vegetable retailing and consumer preference for vegetables. Accordingly, systematic research is needed to understand market development and future practice for specific categories of vegetable retailing.[2]

The global food and grocery retail market was valued at \$11,324.4 billion in 2021 and is projected to grow at a CAGR of 3.0% from 2022 to 2030.[3]

The growth is primarily due to the lockdown of the COVID-19 pandemic, higher consumer spending on groceries, the volume of online grocery sales and consumer polarization. The pandemic has led to the emergence of consumer polarization, where some consumers have resorted to buying expensive products. Additionally, the increase in home cooking due to the pandemic has been a key driver for the market growth. The COVID-19 pandemic has fundamentally changed the food and grocery retail industry. During the first wave of the pandemic, customers rushed to stock up on groceries both in stores and online, with restaurants, businesses and schools closed in most countries. For example, Health England's ", UK food sales rose by around 11.1% compared to the week to June 2020, when the first closures began in March 2020. During the same period in 2019, food retailers were forced to reorganize supply chains, explore private label products and expand supplier networks to meet consumer demand.[4]

According to the World Health Organization (WHO), the daily consumption of fruits and vegetables per person is about 400 g. [5]

However, a 2014 study reported that total daily consumption of fruits and vegetables in Western



countries decreased by more than 10% between 2004 and 2014. [6]

In the past three decades, there have been drastic changes in the marketing system of vegetable products. Modern concepts of marketing are also affecting this market, and customer-oriented approaches are being used effectively. In developing countries, a modern retailing system has emerged, beginning with the third phase of retailing vegetables. [7] Nabard research conducted by 2010 predicts that modern retail sales will continue to grow in double digits.[8]

In addition, retail outlets established for purchasing vegetables do not yet have enough experience to attract their customers and do not have a good understanding of their purchasing behavior. This is different for consumers in large cities than for consumers in medium and smaller cities. [9]

Realizing the high potential of the vegetable market, many organized retail corporations are aggressively entering the market and showing tremendous potential. Understanding the purchasing behavior of customers in Uzbekistan is one of the most important tasks. [10]

The vegetable supply chain is characterized by important and dynamic logistics and management systems that must respond efficiently and quickly to changes required by the market and often determined by consumer demands and needs. [11]

Among the quality characteristics of fruits and vegetables, one of the most discussed aspects is human health. Eating vegetables is associated with the prevention of several diseases. [12]

According to the World Health Organization, low consumption of fruits and vegetables causes about 2.7 million deaths each year, and according to the 2002 World Health Report, it is among the 10 leading risk factors for death. It has been reported that people around the world are currently eating less than the recommended amount of vegetables.[13]

It is known from the review of the reviewed literature that while the population understands the health benefits of fruits and vegetables, their consumption is lower than the recommended amount among adults, not only in Uzbekistan, but in many countries. Therefore, given the dramatic increase in food-related health problems globally, it is important to prioritize formal nutrition marketing activities aimed at increasing health and fruit and vegetable consumption.[14]

3.RESEARCH METHODOLOGY

In the study, forecast models are developed for per capita vegetable retail sales, population growth, and vegetable production volumes. Based on the forecast models, strategic directions aimed at increasing the consumption of vegetables are determined. Accordingly, statistical data on the consumption of vegetables and population in the Republic of Uzbekistan for 2010-2021 will be used. Forecasting models are performed using the SPSS Statistical package. In order to determine these forecast models, SPSS Statistical package program is used to forecast each selected parameter according to the most appropriate linear trend models.

4.ANALYSIS AND RESULTS

According to the World Health Organization, follow-up surveys of chronic disease risk factors in a number of countries, including African countries, have found fruit and vegetable consumption below recommended levels. According to the World Health Organization, daily consumption of vegetables is required to be 400 g/person.

In 2017, about 3.9 million deaths worldwide were attributed to insufficient consumption of fruits and vegetables by WHO. Inadequate consumption of fruits and vegetables causes about 14% of deaths from gastrointestinal cancer, about 11% of deaths from coronary heart disease, and about 9% of deaths from stroke worldwide. [14]

Table 1 shows the comparison of the statistics of the countries of the world on the consumption of vegetables.

Table 1
Coarmptive information on the daily consumption of vegetables in the countries of the world

Name of countries	Daily consumption of vegetables, grams/day
China	176.96
Denmark	162.08
Germany	118.02
USA	255.00
Italy	155.0
Malaysia	133.0
India	105.7
Ghana	36.6
Ethiopia	51.2
Uzbekistan*	119.7

*FAO statistics

Available data show that vegetable consumption is not positively related to the level of development of



countries, with higher consumption in developing countries such as Uganda and China PR compared to developed countries such as Denmark, Germany, UK and France. Average digestibility and body weight in the US are 189.30 g and 255 g per day, respectively. In Hong Kong, 146.81 g/day to 176.96/day of sea-vegetables are consumed, which is 324 g/day. In Germany, fruit and vegetable consumption was reported to be 209 g/day and 228.6 g/day among adults, respectively. It noted that WHO trends have been relatively flat over the past decade and that the Healthy People 2020 targets have not been met.

In declaring 2021 as the International Year of Fruits and Vegetables, the United Nations (UN) General Assembly aims to raise awareness of the nutritional and health benefits of fruits and vegetables and their contribution to a balanced and healthy lifestyle. It also hopes to draw attention to the need to reduce losses

and waste in the fruit and vegetable sector, while also having a positive impact on the environment. In accordance with the Sustainable Development Goals, it is necessary to take measures at the country level to increase the production and consumption of fruits and vegetables and make them more economically accessible to consumers, while creating economic, social and environmental benefits.[15]

Table 2 lists the general statistical data on the retail trade of vegetables in the Republic of Uzbekistan. According to the data of this table, it is possible to calculate the daily consumption volume of retail turnover per capita as the main indicators reflecting the consumption of vegetables according to Table 2. 119.7 grams of vegetables were consumed by the population in 2021, based on the daily consumption of vegetables sold in retail trade in 2010-2021.

Table 2
Consumption of vegetables in the Republic of Uzbekistan

Years	Permanent population, thousand people	Retail sales of vegetables in the domestic market, thousand tons	Vegetables grown per capita, kg.	Retail sale of vegetables per capita, kg	Daily consumption of the population, grams/day
2010	28001.4	1048	223.6	37.4	102.5
2011	29123.4	1084	234.5	37.2	101.9
2012	29555.4	1182	252.4	40	109.6
2013	29993.5	1222	269.7	40.7	111.5
2014	30492.8	1230	287.1	40.3	110.4
2015	31022.5	1347	302.7	43.4	118.9
2016	31575.3	1256	322.5	39.8	109.0
2017	32120.5	1213	318.2	37.8	103.6
2018	32656.7	1339	298.9	41	112.3
2019	33255.5	1442	307.2	43.4	118.9
2020	33905.2	1496.4	307.6	44.1	120.8
2021	34558.9	1511.6	313.9	43.7	119.7

Taking into account the above, it is possible to evaluate the changes in the level of consumption in inertial and modernization directions based on forecasting the development trends of retail trade of vegetables. Based on the data of Table 2 on the consumption of vegetables in the Republic of Uzbekistan, we calculate the parameters of the forecast using the SPSS Statistical package in two directions.

Development according to the inertial scenario is determined according to the periodic development of each forecast parameter without the influence of other

factors. In order to determine these forecast models, SPSS Statistical package program is used to forecast each selected parameter according to the most appropriate linear trend models.

Based on the data in Table 2, the linear trend models of population growth indicators until 2026 are as follows.

$$X1=558,815t+27722,790, \quad (3.1)$$

$$R2=0.998; p(\text{value})= 0.0001;$$

The maximum likelihood model of population changes over time in 2010-2021 is a simple linear



model, and it is possible to determine future changes based on this model.

The "Cubic" linear model of the time-related changes of the vegetable retail turnover in 2010-2021 is calculated with the maximum likelihood, and it is possible to make a forecast based on the following formula:

$$Y = 0,002t^3 - 0,047 * t^2 + 0,853 * t + 36,850$$

(3.1)

$$R^2=0,777; p(\text{value})= 0.0001;$$

As the next indicator, time-dependent linear trend models are created for the changes in the volume of vegetable cultivation per capita over the years.

The "Cubic" linear model of the time-related changes in the production of vegetables per capita in 2010-2021 is a linear model, and it is possible to make a forecast based on the following formula.

$$Y = 0,099t^3 - 2,900 * t^2 + 31,977 * t + 187,301$$

(3.1)

$$R^2=0,950; p(\text{value})= 0.0001;$$

Based on the obtained linear trend models, each variable is represented in Table 3 by calculating the forecast values based on the forecast models until 2026

Table 3
Forecast values of vegetable market development in the Republic of Uzbekistan according to the inertial scenario

Years	Permanent population, thousand people	Vegetables grown per capita, kg	Retail sale of vegetables per capita, kg
2021	34558.9	313.9	43.7
2022	34987.39	330,405	44.39
2023*	35546.2	338,235	45,068
2024*	36105.02	348,581	45.82
2025*	36663.83	362,037	46,658
2026*	37222.65	379,197	47,594

*prediction values

It is known that these indicators are considered as an inertial scenario of vegetable market development. It is known from the forecast values of the development of the vegetable market in the Republic of Uzbekistan according to the inertial scenario that in 2026 the population will be 37222.6 thousand people, and the amount of vegetables grown per capita will be 379.1 kg. Retail turnover per capita will be 44.39 kg in 2022 and 47.5 kg in 2026.

The obtained results are focused on the changes of all selected indicators over time, and forecast models were developed for the development of retail trade of vegetables in the conditions of Uzbekistan, taking into account the growth of the population and changes in the volume of vegetable cultivation. The parameters calculated on the basis of this forecasting model are typical of the modernization scenario, and are based on the hypothesis that the increase in vegetable consumption in the country depends mainly on the real

increase in the population and the measures taken on the distribution of vegetables in agriculture.

Taking into account the above circumstances, the multi-factor regression model obtained using the SPSS Statistical package showed that the development of retail sales of vegetables was inversely related to the cultivation of vegetables, and the results of the statistical test also rejected the possibility of obtaining a model for this connection. Taking into account this situation, the growth of retail sales of vegetables depends only on the increase in the number of the population among the selected factors, and the specific function is expressed as follows:

$$Y = 0,01 * X_1 + 12,11 \quad (3.1)$$

$$R^2=0.548; p(\text{value})= 0.006;$$

Forecast values of vegetable retail trade calculated on the basis of the modernization scenario are presented in Table 4.

Table 4
Forecast values of the development of the vegetable market in the Republic of Uzbekistan according to the modernization scenario



Years	The permanent population is 1,000 people	Retail sale of vegetables per capita, kg	Daily consumption of vegetables, kg/day
2021	34558.9	43.7	121.39
2022	34987.39	47.1	130.83
2023	35546.2	47.7	132.38
2024	36105.02	48.2	133.93
2025	36663.83	48.8	135.49
2026	37222.65	49.3	137.04

The forecast values of the development of the vegetable market in the Republic of Uzbekistan according to the modernization scenario will increase by 2.3 kg per year compared to the forecast values according to the inertia scenario, and in 2026 compared to 2021, it will increase by 3.8 kg per capita. These forecast models provide an opportunity to define strategic tasks aimed at the development of retail trade of vegetables.

5.SUMMARY

Vegetable retailing and marketing is rapidly changing with the introduction of innovative convenience products such as new categories and varieties of vegetables, mixed vegetables and ready meals. These changes are manifesting as 'food trends', which may be caused by external factors such as socio-economic or environmental factors.

It is known from the studies conducted on the study of international experience that the daily consumption of fruits and vegetables by each person is about 400 g. constitutes However, in recent years, increasing the consumption of inorganic productstrends are forcing the international community to use many marketing strategies to increase the consumption of organic products

Vegetable cultivation and domestic consumption in Uzbekistan is characterized by high variability dynamics under the influence of a number of factors. These circumstances require the establishment of clear strategic directions in the organization of the vegetable products sales system.

The market of vegetables in the Republic of Uzbekistan develops only due to the increase in the population. These cases should be considered as the most important way to use marketing activities aimed at increasing the consumption of sazavots, and appropriate measures should be determined in the conditions of Uzbekistan regarding this issue.

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