ISSN 2181-9408

Scientific and technical journal

Sustainable Agriculture

№1(21).2024

Designer: Dilmurod Akbarov.

Note: Only the authors of the article are responsible for the content and materials of the article. The editorial board does not respond to the content of the article!

Founder: Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

Our address: 39, Kari-Niyaziy str., Tashkent 100000 Uzbekistan , www.sa.tiiame.uz

The journal "Sustainable Agriculture" is registered in the Press Agency of Uzbekistan on the 12th of February in 2018 (license № 0957).

In 2019, the journal is included in the list of recommended scientific publications by the Higher Attestation Commission of the Republic of Uzbekistan.

ARCHITECTURE. LANDSCAPE ARCHITECTURE

ECONOMY. ECONOMIC SCIENCE. OTHER BRANCHES OF THE ECONOMY.

REVITALIZING AGRICULTURE THROUGH ORGANIC PRACTICES: A COMPREHENSIVE ANALYSIS OF THE SAMARKAND REGION'S TRANSITION AND CONSUMER DEMAND DYNAMICS

F.Ahrorov, PhD, Associate professor, Samarkand branch of Tashkent State University of Economics

Abstract

This paper examines the impact of agricultural reforms on the structure, methods, and sustainability of agricultural production, with a focus on the Samarkand region. Despite the reforms' success in achieving food security and propelling the nation towards self-sufficiency, they have also led to the degradation of agricultural lands due to intensive farming practices and prioritization of strategic crops. The paper discusses the significance of adopting eco-friendly practices and an adaptive framework for agricultural management to revitalize land quality and promote sustainable resource utilization. Through a comprehensive analysis using the Tobit model, descriptive statistics, and marginal analysis, the study explores consumer behavior towards organic products and the factors influencing their demand, based on primary data collected from the population of the Samarkand region. Results indicate a substantial expansion in areas certified under the international Good Agricultural Practices standard (Global GAP) and a shift towards organic farming, reflecting a commitment to sustainable agriculture and enhanced market competitiveness. The study identifies price, appearance, origin, packaging, and product size as significant determinants of organic food purchasing behavior, along with demographic influences. The findings offer crucial insights for developing targeted strategies to bolster the demand for organic products, highlighting the role of product characteristics and demographic factors in shaping consumer preferences. This research contributes to the literature on sustainable agriculture and consumer behavior, providing valuable perspectives for stakeholders in the organic food sector to drive the organic movement forward.

Keywords: *organic farming, sustainable agriculture, eco-friendly practices, consumer demand, Tobit model.*

Introduction. Agricultural reforms transformed production and property relations, leading to significant shifts in the structure, essence, and methods of agricultural production. These reforms, spurred by socio-economic changes, propelled our nation to achieve self-sufficiency with a robust agricultural base and food security (Ahrorov F. 2012).. The comprehensive Action Strategy, spearheaded by our President, has successfully ushered the agricultural sector into a new era of structural advancements, marking a period of substantial progress and innovation.

However, a retrospective examination of the agriculture reforms, particularly in the Samarkand region, reveals critical challenges. The widespread adoption of intensive farming practices and the prioritized cultivation of strategic crops have detrimentally impacted the quality and sustainability of the agricultural lands, precipitating their degradation. Addressing these issues is imperative to revitalize land quality, enhance soil fertility, and promote the judicious utilization of agricultural resources. Embracing an adaptive framework for agricultural management and incorporating eco-friendly practices are essential steps towards achieving these goals.

Furthering these efforts, the Presidential Decree "On additional measures to ensure that the quality and safety indicators of agricultural products comply with international standards" (dated 18.05.2020, PF-5995), specifically in the Samarkand region, signifies a pivotal move towards establishing organic agriculture. This initiative aims to elevate the quality of food products, augment the export potential of the agricultural sector, and align the safety standards of our agricultural produce with global benchmarks. This strategic direction not only enhances the nation's food quality but also strengthens its position in the global agricultural market.

Literature review. The Tobit model is a powerful analytical tool capable of dealing with the complexities associated with limited dependent variables, especially when consumer demand shows both observable and unobservable characteristics. For instance, a study by Liao et al. (Liao 2023)focused on innovation efficiency in the energy conservation and environmental protection industry, where the Tobit model was used for robustness testing. Although this research did not directly analyze organic product demand, it provided a methodological framework relevant to the application of the Tobit model in environmental contexts. By verifying the accuracy of Tobit regression results using variable substitution methods, the study contributed to the broader understanding of statistical techniques suitable for analyzing censored or limited datasets, such as those common in consumer demand studies for organic products.

Similarly, Chen (Chen 2023) explored the effects of controlling shareholders' equity pledges and environmental regulations on corporate green performance using the Tobit model. The study offered a fresh perspective on how financial and regulatory mechanisms impact corporate sustainability practices. Although the primary focus was not on organic products, the implications for understanding the broader context of environmental sustainability and its intersection with market behaviors were valuable. The application of the Tobit model in this study underscores its versatility in capturing the effects of latent variables on observable outcomes.

Regarding the demand for organic products, Boateng, Donkoh, and Cobbinah (Boateng 2023) investigated the drivers of smallholder farmers' adoption of organic farming practices in Northern Ghana. The researchers used the Tobit model and compared its fit to other regression models to provide empirical evidence on the factors influencing organic farming adoption. This study highlighted the Tobit model's capability to account for censored data, offering insights into the determinants of organic farming that, by extension, affect the supply side of the organic product market.

Similarly, Lin and Chen (Lin 2023) examined revisiting

behavior for luxury resorts, using count data regression with Tobit models, among others. Although the study was focused on the hospitality industry, the methodological approach offers parallels to analyzing consumer demand for organic products. The study demonstrated how the Tobit model can elucidate the factors driving repeat behavior in contexts where the dependent variable is truncated or censored.

The literature demonstrates the applicability of the Tobit model across various contexts, from environmental sustainability and corporate practices to direct analysis of organic farming adoption and consumer behavior. These studies collectively underscore the model's strengths in handling censored data and providing nuanced insights into the factors influencing consumer demand for organic products. Through these diverse applications, the literature contributes to a deeper understanding of consumer preferences and the dynamics of the organic product market, offering valuable perspectives for both researchers and practitioners in the field of sustainable agriculture and consumer behavior analysis.

Data and methods. Descriptive statistics and marginal analysis are pivotal in analyzing consumer behavior, albeit serving distinct objectives. Descriptive statistics delve into the traits of a specific group or sample, employing metrics such as mean, median, mode, and standard deviation. These metrics shed light on the central tendencies and variability within a dataset, aiding in the recognition of consumer behavior patterns, like purchase frequency, product preferences, and demographic profiles of the buyers.

The study on the development of organic farming in the Samarkand region, aimed at enhancing the ecological conditions of agricultural ecosystems, emphasizes the importance of understanding consumer demand for organic products. The methodology involved collecting primary data through surveys among the population to explore the potential demand and supply of organic food across different demographics. This approach offers valuable insights into consumer perceptions, awareness, and behaviors towards organic products, which are crucial for informing policy decisions and marketing strategies.

The Tobit model can be used to analyze the demand for organic products, which may have both observed and unobserved values due to factors such as consumer preferences, product availability, and pricing. The Tobit model can account for the censoring of the dependent variable, which in this case is the quantity of organic products demanded.

The Tobit model can be used to analyze the demand for organic products, which may have both observed and unobserved values due to factors such as consumer preferences, product availability, and pricing. The Tobit model can account for the censoring of the dependent variable, which in this case is the quantity of organic products demanded.

The model can be specified as follows:

$$Y^* = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \varepsilon$$

where Y* represents the latent variable of the quantity of organic products demanded, β0 is the intercept, β1-3 are the coefficients for the independent variables X1-X3, and ε is the error term.

The observed variable, Y, is related to Y* as follows:

Y = 0 if Y* ≤ 0

Y = Y* if Y* > 0

The variables X1-X3 represent factors that may influence the demand for organic products, such as consumer income, product prices, and marketing efforts. The coefficients β1-3 represent the marginal effects of each variable on the quantity of organic products demanded.

The equation for the results of marginal analysis in a Tobit model calculated in STATA is:

$$yi^* = \beta 1X1i + \beta 2X2i + \ldots + \beta kXki$$

where:

yi* is the latent variable for the dependent variable yi

β1, β2, ..., βk are the coefficients for the independent variables X1, X2, ..., Xk

X1i, X2i, ..., Xki are the values of the independent variables for the ith observation.

Results and discussion. To optimize agricultural land utilization, boost the sector's export capabilities, and ensure the populace has access to high-quality food items, the Samarkand region is actively promoting the development of organic agriculture and the production of organic foodstuffs, in line with a directive from the President of the Republic of Uzbekistan. Between 2020 and 2025, projected benchmarks for certifying land in compliance with the Global Good Agricultural Practices (Global G.A.P.) standards were established for key export-oriented crops. The goal is to methodically transition these agricultural lands to organic production.

This shift towards ecologically sustainable agricultural production, aligned with Global G.A.P. standards, and the commitment to organic product manufacturing, underscore the region's dedication to environmental stewardship and health-conscious food production. To accurately gauge both the demand for and supply capacity of organic foods, comprehensive monographic studies and consumer surveys have been conducted. These efforts are part of a broader strategy to harmonize agricultural practices with ecological principles, thereby enhancing the region's agricultural output and its appeal on the international market, all while meeting the domestic demand for nutritious, organically produced food.

The projections indicate a substantial expansion, from 20 hectares certified in 2020 to an anticipated 2,830 hectares by 2025. Moreover, a significant portion of this land, totaling 1,777 hectares, is earmarked for a gradual transition towards organic farming practices. This strategic shift underscores a commitment to sustainable agriculture, aiming to bolster the export potential of these crops while adhering to internationally recognized standards of agricultural excellence. This initiative not only enhances the environmental sustainability of the region's farming practices but also positions it favorably in the global market, offering a competitive edge through adherence to esteemed agricultural protocols (Diego Azqueta, 2007).

The projections across districts of region reported that Kattakurgan district is very committed to Global GAP standards, particularly in cotton cultivation, with a minor focus on organic practices.

Table 1.

The state of production of products based on international standards in the districts of Samarkand region

Districts	Total	International standards		Products grown in accordance with internationally recognized organic standards and requirements					Products cultivated in compliance with the international Global GAP standard requirements			
		Organic	Global GAP	cotton	legumes	vegetable	garden	grapes	garden	grapes	vegetable	policy
Kattakurgan	143	120	23	104	9	7					20	3
Narpay	117	92	25	85	7						25	
Pahtachi	85	85		82	3							
Istikhan	380	168	212	67	6	1		94		210		2
Payarik	441	206	235	106	5			95		235		
Kushrabat	104	74	30					74		30		
Pastdargom	159	85	74	50	10	5	20		60		10	4
Nurabad	53	25	28		3	2	20		25			3
Samarkand	951	193	758		4	16	69	104	300	432	26	
Urgut	691	178	513		5	13	70	90	110	365	38	
Akdarya	205	95	110	50	12	3	30		90		20	
Jomboy	610	138	472	10	6	17	105		410		60	2
Burungur	588	300	288				300		288			
Taylaq	80	18	62		6	12			20		42	
Samarkand region	**4 607**	**1 777**	**2 830**	**554**	**76**	**76**	**614**	**457**	**1 303**	**1 272**	**241**	**14**

On the other hand, Narpay and Pahtachi districts strongly emphasize organic cultivation, with Narpay also demonstrating a commitment to Global GAP compliance. Istikhan and Payarik districts stand out for their large-scale cultivation under organic and Global GAP standards. This demonstrates a diversified agricultural strategy including organic and Global GAP practices. Kushrabat district is unique since it exclusively focuses on Global GAP standards for garden and grape cultivation. Pastdargom, Nurabad, Samarkand, Urgut, Akdarya, Jomboy, Burungur, and Taylaq districts offer a mix of organic and Global GAP practices, with specific focuses varying by district. Cotton and legumes are mainly grown under organic standards, indicating a preference for organic practices in these crops.

In contrast, vegetables and grapes are more commonly cultivated under Global GAP standards, which may reflect market demands or the specific requirements of these crops for certification. The total figures suggest a strategic shift towards more sustainable farming practices, with a substantial area dedicated to organic and Global GAP standards. The balanced focus on organic and Global GAP standards highlights a comprehensive approach to sustainability and safety in agriculture, meeting local consumption and export demands. Notably, the transition towards sustainable agricultural practices is not uniform across all districts, reflecting each district's varying geographical, climatic, and socio-economic conditions. Nevertheless, the commitment to organic and Global GAP standards indicates a forward-looking approach to agriculture, aiming to improve product quality, environmental sustainability, and market competitiveness.

Ensuring food security necessitates a delicate balance between supply and demand. As the government of Uzbekistan embraces eco-friendly production practices, there's a growing interest in "eco-products," such as those that are organically produced or cultivated in accordance with Global G.A.P standards. To understand the dynamics of market demand for these eco-products, surveys were conducted, and analyses were performed to uncover the willingness of local consumers to purchase these sustainable options. Specifically, the Tobit model, an econometric tool well-suited for analyzing demand where there are limits to observable responses, was employed to scrutinize the demand for organic products. This approach allows for a nuanced understanding of consumer behavior and preferences, informing strategies to align agricultural production with environmental sustainability and consumer demand for eco-friendly products.

Given the context of analyzing the frequency of purchasing organic products at least once a week as a dependent variable, and various factors influencing purchasing behavior, current activity, level of education, age, household size, responsibility for purchasing food, and satisfaction with the monthly food budget as independent variables, it's essential to understand the role of each variable and how they might impact the dependent variable.

To accurately gauge the marginal effects and their influence on the demand for organic products, this study calculated the partial derivatives of the predicted probability of observing a non-zero value of the dependent variable (Y) concerning each independent variable, evaluated at the average values of these variables. Such an approach offers nuanced insights into the determinants affecting consumer preferences for organic foods, serving as a cornerstone for developing targeted pricing, marketing, and strategic initiatives aimed at bolstering demand.

The empirical data encompasses individuals' propensity to purchase organic food, delving into the impact of various determinants on these purchasing decisions, alongside demographic information including age, education level, employment status, household size, and the role in food purchasing decisions.

Table 2.

Key statistics of Tobit model

	How often are you willing to buy organic products: Fruit at least once a week	How often are you willing to buy organic products: Vegetable at least once a week	How often are you willing to buy organic products: Milk at least once a week	How often are you willing to buy organic products: Meat at least once a week	How often are you willing to buy organic products: Bread at least once a week	How often are you willing to buy organic products: Egg at least once a week	How often are you willing to buy organic products: Fish at least once a week
I am aware what organic (eco-friendly) food is	0,314	0,115	0,111	0,122	-0,053	0,191	0,129
st.error	0,099	0,082	0,087	0,016	0,018	0,098	0,09
In your purchasing behavior what factors play an important role: price	0,005	0,028	-0,009	-0,061	-0,014	-0,015	-0.0568*
st.error	0,039	0,035	0,051	0,048	0,031	0,044	0,033
In your purchasing behavior what factors play an important role: how product looks	-0,002	0,169	-0,061	-0,05	-0,027	-0,057	-0,015
st.error	0,041	0,042	0,056	0,054	0,037	0,052	0,041
In your purchasing behavior what factors play an important role: origin of product	0,044	0,0964	0,0838	-0,017	0,031	0,159	0,112
st.error	0,04	0,042	0,044	0,041	0,035	0,043	0,04
In your purchasing behavior what factors play an important role: package	0,058	0,047	0,0862	0,1308	0,031	0,0852	-0,026
st.error	0,043	0,042	0,05	0,041	0,034	0,046	0,048
In your purchasing behavior what factors play an important role: size of product	-0,052	-0,0565	-0,022	-0,014	-0,005	-0,025	0,033

The study unveiled distinct preferences within organic food categories: fruits (0.314), eggs (0.191), and vegetables (0.115) emerged as the most favored choices, whereas bread (-0.053) reflected a reluctance towards organic options. Moderate preferences were observed for milk (0.111), meat (0.122), and fish (0.129), presenting a diversified landscape of consumer inclination towards organic food.

Analyzing factors influencing purchasing behavior revealed that price significantly affected all categories, barring milk. Vegetables' appearance (0.169) was paramount, whereas the origin markedly influenced fruits (0.044), vegetables (0.096), and fish (0.159). Packaging stood out for milk (0.086), meat (0.1308), and fish (0.0852), with product size being pivotal for meat (-0.0565) and fish (-0.025) but not others.

Demographic analysis indicated a marginally higher willingness among unemployed students and pensioners to opt for organic choices, albeit not statistically significant. A notable revelation was the negative correlation (-0.1484) between individuals responsible for purchasing food and their likelihood of choosing organic options. The education level presented mixed effects: negative for high school (-0.073) but positive for higher education levels, including college degrees (0.023), bachelor's degrees (0.023), and post-graduate degrees (0.1092). Age and household size did not significantly sway organic food purchasing habits, while satisfaction with the monthly food budget slightly enhanced the willingness to purchase organic products.

This comprehensive analysis sheds light on the multifaceted factors influencing consumer willingness to engage with the organic food market. It underscores the pivotal role of product characteristics—price, appearance, origin, packaging, and size—in shaping purchasing decisions. Moreover, it highlights the nuanced impact of demographic factors on consumer behavior. These insights are invaluable for stakeholders in the organic food sector, equipping them with the knowledge to refine marketing strategies and align offerings with consumer preferences, thereby driving the organic movement forward and fostering sustainable agricultural practices.

Table 3.
Impact of Product Characteristics on Consumer Preferences for Organic Food Categories

Factor	Effect on Fruit	Effect on Vegetable	Effect on Milk	Effect on Meat	Effect on Fish
Price	Important	Important	Negligible	Important	Important
Appearance	-	Most Important	-	-	-
Origin	Important	Important	-	-	Important
Packaging	-	-	Important	Important	Important
Product Size	-	-	-	Crucial	Crucial

Regarding the impact of product characteristics on consumer preferences for various organic food categories, the recommendation for organic products to be produced in the Samarkand region can be refined to better align with these consumer preferences. The analysis underscores the significance of price, appearance, origin, packaging, and product size in influencing consumer choices across different organic food categories.

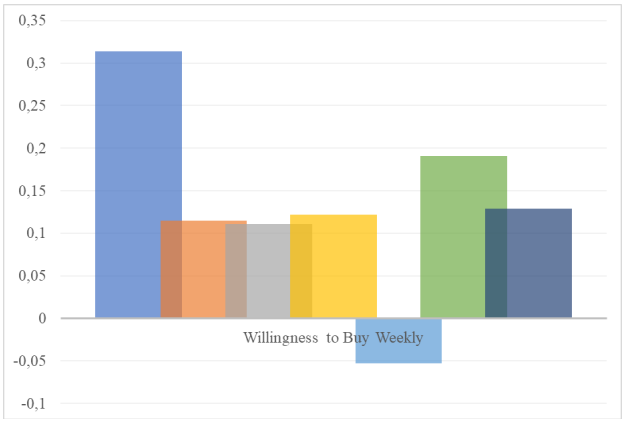

Figure 1. Impact of factors on willingness to buy of organic food in Samarkand region.

Given that price and origin are important factors, and appearance significantly influences consumer preferences for vegetables (which may extend to fruits given their similar market dynamics), focusing on aesthetically pleasing, locally-sourced fruits like apricots, peaches, and pomegranates will be beneficial. Efforts should be made to competitively price these fruits and highlight their local origin in marketing campaigns.

The appearance of vegetables is of paramount importance to consumers, alongside price and origin. This suggests a focus on high-quality, visually appealing vegetable varieties such as tomatoes, carrots, and leafy greens. Emphasizing the local origin and maintaining competitive pricing are also crucial. Since packaging is important for milk but price has a negligible effect, investing in distinctive, eco-friendly packaging that appeals to the environmentally conscious consumer, without the need to compete primarily on price, could differentiate Samarkand's organic milk in the market. The importance of price, packaging, and product size suggests that organic meat production should focus on offering well-packaged, reasonably priced options, with attention to portion sizes that cater to consumer preferences. This could involve offering a range of product sizes to meet diverse needs. Similar to meat, fish preferences are influenced by price, origin, packaging, and product size. Providing organic fish with clear origin labeling, in varied and convenient sizes, and in attractive packaging can cater to consumer demands. Competitive pricing and emphasizing the local or sustainable sourcing of the fish could enhance its market appeal.

Conclusion. To successfully introduce these organic products, producers in the Samarkand region should:

- Ensure that all organic products are clearly labeled with their origin to capitalize on consumer interest in the provenance of their food.
- Develop and utilize attractive, sustainable packaging for milk, meat, and fish, reflecting the importance of this factor in consumer decision-making.
- Consider product size variations, especially for meat and fish, to cater to different household needs or preferences.
- Maintain a competitive pricing strategy for fruits, vegetables, meat, and fish, while leveraging the premium that consumers are willing to pay for organic products.

By aligning the production and marketing of organic products with these consumer preferences, the Samarkand region can better meet domestic demand and enhance its position in international markets. This approach not only supports sustainable agricultural practices but also leverages market insights to ensure the economic viability of organic farming in the region.

References:

1. Decree of the President of the Republic of Uzbekistan No. PF-4041 on measures to optimize food crops and increase their cultivation. October 20, 2008. Lex.uz
2. Decree of the President of the Republic of Uzbekistan No. PF-5853 on approval of the strategy for the development of agriculture of the Republic of Uzbekistan for 2020-2030. October 23, 2019. Lex.uz
3. Ahrorov F., Niyazov I. "The nonarable Aral: loss of productivity in uzbek agriculture ." In Disaster by Design: The Aral Sea and Its Lessons for Sustainability., 175-186. Emeralds, 2012.
4. Allen, P. a. (2000). The capitalist composition of organic: The potential of markets in fulfilling the promise of organic agriculture. Agriculture and human values, 221-232.
5. Lin, S.Y., & Chen, W.J. "Revisiting Behavior for Luxury Resorts in Northern Taiwan: A Case Study of Three Hot Spring Resorts." Business and Technology Innovation Journal, 2023.
6. Liao, G., Liu, Y., Wang, W., & Jiang, M. "Research on the Measurement and Influencing Factors of Innovation Efficiency of Listed Companies in the Energy Conservation and Environmental Protection Industry." Theoretical Economics Letters, 2023.
7. Diego Azqueta, Daniel Sotelsek,. "Valuing nature: From environmental impacts to natural capital." Ecological Economics 63, no. 1 (2007): 22-30.
8. Chen, M. "Controlling Shareholders' Equity Pledges, Environmental Regulations and Corporate Green Performance—Based on Data from Listed Companies in Highly Polluting Industries." Proceedings of the 2023 International Conference on Economic Management and Green Development. Springer, 2023.
9. Boateng, V.F., Donkoh, S.A., & Cobbinah, M.T. "Drivers of smallholder farmers' organic farming adoption and the organic share of the total cropland in Northern Ghana." All Life, 2023.
10. Tilman, D., Fargione, J., Wolff, B., D'Antonio, C., Dobson, A., Howarth, R., Swackhamer, D. (2001). Forecasting Agriculturally Driven Global Environmental Change. Science, 281-284.
11. Schoonbeek, S. A. (2013). Organic agriculture and undernourishment in developing countries: Main potentials and challenges. Critical reviews in food science and nutrition, 917-928.
12. Monireh Faramarzi, H. Y. (2010). Modeling wheat yield and crop water productivity in Iran: Implications of agricultural water management for wheat production. Agricultural Water Management, 1861-1875.
13. Latruffe, L. (2006). Mathematical Models of Agricultural Supply. Encyclopedia of Life Support Systems.
14. Ghorbani, R. K. (2010). Organic agriculture and food production: Ecological, environmental, food safety and nutritional quality issues. Sociology, organic farming, climate change and soil science, 77-107.
15. Bhardwaj, R. K. (2019). An Organic Agriculture Model in India using Mathematical Modelling. International Research Journal of Engineering and Science.