




ASSESSMENT OF ECONOMIC RELATIONS BETWEEN ACTORS OF THE TOMATO PRODUCTION CHAIN

 **Khusniddin Pardaev**¹, Ph.D. student;  **Shavkat Hasanov**², Doctor of science in economics;
 **Shukrullo Muratov**³, Ph.D. student; **Fotima Saydullaeva**⁴, Ph.D. student

^{1, 2, 3, 4}Samarkand branch of Tashkent State Agrarian University, Samarkand, Uzbekistan

Abstract. This article is aimed at analysing the economic interrelation between actors in the tomato production chain in Uzbekistan and find ways to increase the smallholders' income. We used a PROBIT model to determine the influence of exogenous and endogenous factors on the choice of a small trading partner. The customers that come to the smallholders' house to purchase the product are regarded as an exogenous factor. More attention needs to be paid to increasing value-added in the food chain in Uzbekistan and improving economic relations between its actors. The factor obtained as an instrumental variable is assessed as having a positive and high impact on the choice of smallholder intermediate trade partner. In other words, an increase in the level of acquaintances of intermediaries with smallholders will increase economic cooperation by 1.2 times, an increase in family income from agriculture by 19% and an increase in smallholder activity in the *mahalle* by 15.7%. It is estimated that the increase in the number of respondents' livestock per unit, foreign experience per year and the level of use of credits per unit will increase economic cooperation with direct consumers by 34.4, 13.4 and 28.5%, respectively. It also provides guidelines for tomato farmers to reduce transaction costs and risks and increase their profitability.

Keywords: agricultural cooperative, agricultural supply chain, agrifood, smallholder cooperatives.

JEL code: Q13.

Introduction

In developing and transition economies, agricultural producers play a crucial role as a source of sustainable food production, high yields, and income for human consumption (Neven D., 2014). According to the Food and Agriculture Organization (FAO) 2020 statistics, 12% of the arable land in the world is accounted for by small farms, which produce more than 80% of the total agricultural output (Gomez y Paloma S. et al., 2020). Most of these farms are located in rural areas and face many problems in their economic activities, such as transaction costs and high risk associated with the production and sale of products (Abebe G. K. et al., 2013). Such farms have limited land, non-guaranteed product prices and market, lack of production resources, un-satisfactory infrastructure and introduction of modern knowledge and technologies in production, and insufficient government support (Otsuka K., Nakano, Y. and Takahashi K., 2016; Saitone T. L. and Sexton R. J., 2017; Boys K. A. and Fraser A. M., 2019; Reardon T. et al., 2019; Meemken E. M. and Bellemare M. F., 2020). In addition, they did not integrate into the food production chain system (WHO, 2020), and issues related to the production and sale of the product have been neglected (FAO, 2017). To improve the system of agricultural production and supply chain in the Republic of Uzbekistan, it is required to enhance the economic relations between the entities in the production chain, and the widespread introduction of marketing relations in the sector. In this regard, it is principal to eliminate inconsistencies in the formation of reproducing of agricultural and livestock products, which are strategically supreme for smallholders with high potential in the production of food products within the forms of productive farms. In the supply chain, no guaranteed prices and markets, unstructured supply input resources, and lack of quality controls are considered problem statements. Furthermore, the overall profit is low, and herewith, the transaction cost is high.

With the development of society, new opportunities are emerging to increase the income of smallholders from agricultural activities (Simmons P., 2002; Muratov S. A., 2021b; Pardaev K. and Hasanov S., 2020).

1 E-mail: pardayev@yahoo.com; phone +998 993895537

2 E-mail: shavkat_hasanov@hotmail.com; phone +998 915428137

3 E-mail: shukrullo.muratov@yahoo.com; phone +998 938348383

4 E-mail: fsaydullayeva@yahoo.com; phone +998 915290327

These capabilities giving opportunity in the supply of raw materials in the production chain, quality control, guaranteed market, and price through the conclusion of contracts in a clearly defined period. Unfortunately, ensuring the financial and economic sustainability of agricultural products, preparation, processing, supply, service, and purchasing relations are not at the level of systematic by the modern market mechanism.

However, the activities of actors in the chain of agricultural production in Uzbekistan are becoming contemporary in some sub sectors. In this regard, opportunities for producers to deliver products 'from the field to the table' and thus increase their income (Bobojonov I. et al., 2016).

According to the literature, the middleman can facilitate the marketing of the product but reduce their income by offering low prices (Abebe G. K. et al., 2016; Masters A., 2008; Ranjan R., 2017). The middlemen use asymmetric information to minimize the product price and sell it more expensive in wholesale and markets (Muratov S. A., 2021b). Abebe G. K. *et al.*, (2016) argues that smallholders sell their products through the middlemen because of social affinities between them when farmers have the opportunity to sell their products directly to consumers at high prices.

This article aimed to analyse the economic relations between actors in the tomato production chain in Uzbekistan and find ways to increase the income of smallholders. Based on the purpose, this paper addresses two related questions. First: For what reasons do smallholders establish trade relations with intermediaries? Next: Which trading partner do smallholders prefer to sell their product? We conducted a cross-sectional survey of tomato producer smallholders. We randomly selected 197 respondents for participation in the study from the total 6 districts of Samarkand Province of the Republic of Uzbekistan. The selected respondents have produced tomatoes in the summer seasons in their house plots or rented plot land from private farms.

Tomato production condition and methodological framework.

Most of the vegetable products are grown by smallholders in Uzbekistan. According to the statistics, since the independence of the Republic of Uzbekistan, their consideration nearly 70%.

Plenty of vegetable products were from the Samarkand regions. It was 1636.3 thousand tons and consisted of 15.6% of the total in 2020. At the same time, 15.3% was by Andijan, 10.8% by Fergana, and 10.2% by Tashkent regions. Due to its high share in production, the Samarkand region was selected as an object.

Tomatoes accounted for a large share of planted vegetable land in the Samarkand region, namely consisted of 31.2% among other vegetables. Historically, tomatoes have been grown in large areas in Uzbekistan, especially in Samarkand, and have a high yield and income (Hasanov S. et al., 2014). Tomato production is a high cash income for smallholders in rural areas (Rudenko I., 2008). However, the tomato has a strict character associated with production and sale (de Jesus Salas-Mendez E. et al., 2019). In particular, compared to other agricultural products produced by smallholders, the market life of tomatoes is short, requiring special boxes and equipment for transportation. In addition, tomato harvesting requires more labour force and capital endowment (Geoffrey S. K. et al., 2014). Above mentioned uncertainties bring smallholders difficulties and high risks.

Methodological framework

The conceptual framework considers analysing the economic relations of actors in the tomato production chain and describes the ways to reduce the transaction costs and risks, as well as identifies the trade channels which can give smallholders high returns. At first, we provide the characteristics of the participation of actors in the supply chain of tomatoes. Next, we explain how to determine the relationship

between the producer and the buyers. According to the studied object, the buyers of tomatoes produced by smallholders are mainly middlemen, processing companies, grocery markets, bazaars, and social institutions (canteens, hospitals, and others). This individual actor can be counted as a separate individual institution of each.

The middlemen. As in most sectors, the participation of the middlemen in the tomato production chain in Uzbekistan is significantly higher than in other marketing channels. Although they are informal actors in the tomato production chain system, they seem like a market for products that are convenient for producers (Abebe G.K. *et al.*, 2016). They help smallholders sell their products faster and reduce transaction costs, even if they do not have a legal agreement. However, in much of the literature studied, intermediaries use asymmetric information to lower product prices and sell more to the next block chain (such as consumers or wholesalers) to make more money (Masters A., 2008; Lee J. *et al.*, 2012; Ranjan R., 2017). As a result, their participation leads to an increase in the price and to decrease in the smallholders' income. Although, smallholders know that they sell the product to the middlemen cheaper than other sales channels. This interconnection in the chain is due to various endogenous and exogenous factors.

Processing companies. Although the tomato processing sector in the food chain is not sufficiently well developed in Uzbekistan (Sanaev G. *et al.*, 2015), these companies make a significant contribution to tomato paste and canned goods for domestic consumption and export. Currently, there are 16 tomato processing companies in the Samarkand region (Statistical yearbook of Samarkand, 2020. www.samstat.uz). These companies place orders with smallholders on a contractual basis. Processing companies are a large market for purchasing tomato products from them. However, low prices and payment delays reduce the willingness of the *dehkans* to sell tomatoes in this market. But, companies do not set strict requirements for product quality.

Grocery market. The development of the economy is expanding new marketing opportunities for smallholders to sell their products, increasing the number of modern outlets (mini, super, and mega markets) and export opportunities. However, unfortunately, ensuring the financial and economic stability of smallholders, their interaction with procurement, processing, supply, service, and procurement organizations are not in line with the requirements of modern market mechanisms. Furthermore, the convenient type of agreement is not introduced between smallholders and groceries.

Bazaars. The local *dehkan bazaars* were established in rural areas and rural centres for smallholders to sell their products. Typically, most smallholders are committed to selling in such markets any product which they have produced. According to the statistics, in the Samarkand region is the available total of 36 large *dehkan bazaars*, and small producers' fairs in each village centre, intended for retail and wholesale the agricultural products (Statistical yearbook of Samarkand, 2020. www.samstat.uz). In Uzbekistan, such markets can be separated into two categories due to their location in urban and rural areas. A large number of buyers in urban markets leads to higher prices for products. Since most of the urban population has no chance to produce agricultural products, they buy from *bazaars* and groceries. Most smallholders want to sell their products in this channel because they want to sell tomatoes at a free market price, in cash, and receive the payment on time. These bazaars are a unique place for them to sell since small farms produce less. In addition, the cost of transporting to the bazaar is cheap. However, due to a large number of small producers, the bazaars cannot accommodate all of them.

The social institutions (e.g. canteens, hospitals, hotels, restaurants and others). Social institutions are also a big market for smallholders. Although, this sales channel offers a high price and a guaranteed market. It requires the product to be delivered to and pays close attention to quality. Due to

the characteristics, the time frame, and high transportation costs, smallholders are often reluctant to supply them.

We will study the buyers in two groups depending on the characteristics of their participation in the tomato supply chain. The first is selling smallholder tomatoes to the middlemen, and the second is direct consumers (combined in processing companies, grocery markets, bazaars, and social institutions). The criteria of the trade agreement, transaction cost, price, and social relations were taken into account in the formation of these groups.

Table 1

Variable definition and descriptive statistics of sampled smallholders of Samarkand province

Independent Variables	Smallholder selling through the middlemen (n=110)		Smallholder selling direct to buyers (n=87)	
	Mean	Std. Dev.	Mean	Std. Dev.
Distance to processing company (km)***	28.709	19.378	35.529	20.463
Livestock (%yes)	91.000	.289	95.400	.211
The primary benefit of the respondents family (%yes)*	80.000	.402	69.000	.465
Age of the family head (years)	43.300	10.600	44.046	11.917
Achieved the last degree of the respondent a	1.945	1.187	2.069	1.237
Foreign experience (%yes)	25.500	.438	31.000	.465
Working force hired	3.345	9.721	3.391	4.711
Processing company product rejection (%yes)	6.000	.351	7.000	.313
Decision maker/s in the family b	1.882	1.194	1.851	1.225
Used credit (%yes)***	1.000	.095	12.000	.321
Respondent activities in the mahalle (%yes)	77.000	.421	77.000	.423
Calling to Khashar in tomato production (%yes)*	25.000	.415	33.000	.465
Family other income (%yes)	92.700	.261	88.500	.321
Treasure of the respondent (% of rich)	18.000	.387	17.200	.380
Producer and buyer relation (%yes)***	85.500	.354	9.200	.291
Clients came to the farm gate to purchase tomato (%yes)***	98.200	.134	71.300	.455

Source: author's calculations based on questionnaire data

^a No education = 0; School = 1; Collage = 2; Bachelor = 3; Master = 4; 5 years HEI education = 5

^b Husband - 1; Wife - 2; Husband and wife - 3; All family members (husband, wife and children together)-4

*** $p < 0.01$, * $p < 0.1$

We need to determine which sales channel is preferred by smallholders when selling products in the tomato production chain. It is directly related to the income of smallholders, transaction costs, and production risks (Pardaev K., 2021). We have taken into account the following indicators as factors influencing the choice of buyers in economic relations of tomato production. These figures were in descriptive statistics (Table 1). Age of family head, achieved the last educational degree (Fischer E. and Qaim M., 2012; Abebe G.K., 2016), foreign experiences, and respondent activity in the *mahalle* were each

respondent (family head) personal proxies. In general, the respondent who would be active in the *mahalle* acquire more information about price and preferable marketing channels. People of this character are actively involved in other spheres in tomato production.

Distance to the processing company hired working force, used credit, and calling to *khashar* variables are refers as a proxy for the expenses-related variable. Some clients came to the farm gate to purchase the tomato, the number of livestock of the respondent, the primary benefit of the respondent family, family members' extra income, and treasure of the respondent variables may exogenous factor influence the choice of a trading partner.

Product rejection by a processing company (clients' breaking the agreement) can change smallholders to sell their product to the intermediaries. Collected survey data demonstrate that the property of a respondent was summarized and divided into rich (18% of the total respondents) and poor (82% of the total respondents) classes. This latent variable accounted for each respondent's livestock units, vehicles, TV, phone, refrigerator, and greenhouses.

Akaike information criterion (AIC) and Bayesian Information Criterion (BIC) results demonstrated that two latent classes are optimal (Table 2). When we divided the classes into three, the AIC index decreased from 3660.697 to 3642.513 compared to the third class, but the BIC index increased from 3772.326 to 3793.54. Therefore, the optimal number of classes is determined, the optimal class for AIC and BIC will be determined when the smallest AIC and BIC values are found (Nylund K.L. *et al.*, 2007).

To prove once again the optimality of the number of classes, the entropy is modelled. According to the entropy rule, the optimality will be found when the result is close to one (Good I.J., 1963). The entropy helped us identify that it is advantageous to divide the optimal number of classes into two.

Table 2

**Wealth latent class model fit indices
 (Akaike information criterion and Bayesian information criterion)**

Classes	Observations	Log-likelihood model	Free parameters	AIC	BIC	Entropy
1	197	-1987.757	22	4019.515	4091.745	.47
2	197	-1796.349	34	3660.697	3772.326	.72
3	197	-1775.257	46	3642.513	3793.540	.73

Source: author's calculations based on questionnaire data

Note N=Obs used in calculating AIC=Akaike information criterion; BIC=Bayesian Information Criterion.

Data. The survey interview was conducted in six districts of the Samarkand region in January-March 2021. Except for small-scale farmers, *khokimiyat specialists* and vegetable-growing district intermediaries were interviewed to develop the study. Distance, production capacity, infrastructure, access to irrigation water, number of tomato growers, and other indicators were selected following their instructions. The respondents grew tomatoes in their house yards, on small plots and land subleased from farmers. According to the data, in 2019, household plots and small farmland were planted on 0.04-0.4 hectares, while small farmers who rented land from farmers accounted for 0.3-5 hectares.

Methods. The choice of smallholders to sell tomatoes to an intermediary or directly to a consumer depends on several exogenous and endogenous factors. Based on the above and the nature of tomato buyers in the production chain, it is necessary to identify the exogenous factors that influence the choice of marketing partners for smallholder products. When identifying partners of smallholders, each respondent was able to communicate with other agents (Krishnan P. and Sciubba E., 2009; Abebe G.K., 2016). Thus, we determine the influence of exogenous and endogenous factors on the choice of a small trading partner

(Feder G. *et al.*, 1985). To determine this, it is recommended to use the probit model. A probit model seems most appropriate since the actual level of utility for each smallholder U_i is not observed, the part of each smallholder's utility function that is observable can be expressed as a function of a vector of exogenous variables X_i and a vector of parameters β to be estimated:

$$\text{where: } U_i = V_i(\beta' X_i) + u_i; V_i(\beta' X_i),$$

X_i represents a vector of socioeconomic characteristics and variables related to social network structure; and U_i is the unobservable portion of the smallholder's utility, which is assumed to be independently and identically distributed.

A smallholder will choose to sell tomatoes through middlemen if the utility gained from intermediation, U_i^M , is greater than the utility from selling directly to the second group (direct to consumer), U_i^P . The probability of a smallholder selling a tomato through a middleman is given by $p(u_i < \beta' X_i)$. The fact that the error term is modelled to have a standard normal distribution motivates the use of a probit model (Abebe G.K. *et al.*, 2016). Thus, the model to be estimated is given by:

$$p(M_i = 1) = p(u_i < \beta' X_i) = \beta' X_i + u_i, \text{ for } i = 1, \dots, N, (1)$$

where: $M_i = 1$ if $U_i^M > U_i^P$, and $M_i = 0$ if $U_i^M \leq U_i^P$

Results

The sale channel of tomatoes is divided into two groups of small-scale farmers (Table 1). The results show that 55.8% of respondents preferred to sell through intermediaries and 44.2% directly to consumers. Differences in the average value of indicators between groups, distance to the processing company, the main benefit of the respondents' family, the loan used in the production of tomatoes, the use of *khashar* in the production of tomatoes, the relationship between the producer and the buyer, and customers' coming to the farm gate to buy were immense. In particular, for respondents who prefer to sell tomatoes to intermediaries, the average distance to the processing company is closer than other sales channels. Families that benefit from agriculture prefer to sell tomatoes to intermediaries than others. And very few of them use lending opportunities; moreover, only one percent of them took advantage of the credit. However, also in the other group very few smallholders received loans. Intermediaries often hire workers to harvest tomatoes when they purchase from the smallholders. In such cases, smallholders do not charge to harvest tomatoes. Therefore, they are less involved in harvesting tomatoes by *khashar*. In other cases, smallholders are encouraged to harvest tomatoes by *khashar* to reduce the costs if they sell tomatoes to processing companies, markets, supermarkets, and other channels. According to the results of analysis, smallholders connected with intermediaries through exogenous factors. Therefore, the respondents who sold tomatoes through this channel showed a pre-existing relationship with buyers (long-time trading partners, old acquaintances etc.). Clients who came to the smallholder gate to purchase tomatoes were also considered as an exogenous factor. Respondents who preferred to sell products to intermediaries may have wanted customers to come to the farm gate to buy tomatoes.

According to the results in Table 3, the smallholder acquaintance with the intermediaries may increase the smallholder's trade partnership with the middlemen by 1.2 times. The increase in each number of livestock reduces the desire to sell tomatoes to intermediaries by 0.34%. Except for food security, livestock is important as a financial bank for the rural population. Smallholders, who have more livestock units, are reluctant to sell their tomatoes to the middlemen. Because for smallholders, livestock in a sense as a bank, which gives them financial security. At the same time, if the main income of smallholder families is related to the production of tomatoes, it means that they want the product to be sold earlier and have more cash.

Since the results of the model show that the increase in respondents' income per unit of the outcome are associated with tomato production, it increases the willingness to trade partnership with the middlemen by 19.1%. The one who has gained experience in foreign countries is less likely to be a partner with the middlemen. As we would expect that smallholders want to hire fewer workers because hiring workers will increase their expenses. If smallholders sell products through the middlemen, usually the middlemen hire workers to harvest tomatoes. The reason why middlemen tend to hire workers is that workers try to harvest quality tomatoes when they are hired by the middlemen. Middlemen pay workers every kilogram of tomatoes or for their daily work. Therefore, a smallholder who needs to hire more workers wants to be a trade partner with middlemen. Smallholders who use loans are more likely to sell their products directly to consumers.

Due to the repayment of the loan and its interest rate, smallholder tries to sell the product at a higher price. Based on this theory, an increase in the use of loans by one unit reduces the trade partnership with middlemen by 28.5%.

It became clear that those respondents who were active in the *mahalle* were more likely to be trade partners with middlemen. As we hypothesize, there could be a social network between middlemen and smallholders. Active respondents in the *mahalle* are friendlier because they communicate easier and they get along with people quickly. Middlemen often go to the gates of smallholders to buy products. When they encounter people who are active in the *mahalle*, the trade deal is quickly resolved and the product is acquired by the middleman. Thus, the increase in the level of activity in the *mahalle* will increase the trade partnership with middlemen by 15.7%. In addition, we studied the effects of age of the family's head, education, processing companies' product rejection, family members' decision in marketing, *khashar* call to tomato harvest, other income of the family, and wealth of the respondent as control variables. However, the effect of these variables was not statistically significant.

As we expected, there is a positive social connection between the middlemen and the smallholder. If intermediaries are already familiar with smallholders and know each other well, they are more likely to become partners in the tomato trade.

Table 3

Estimation of probit model (1=selling through the middlemen; 0=selling direct to buyers)

Variables	Coef.	Std.Err.
Producer and buyer relationship	1.205***	.185
Distance to the processing company	-.003*	.002
Livestock unit	-.344***	.112
The primary benefit of the respondent	.191***	.067
Age of the family head	-.001	.003
Achieved the last degree of the respondent	.021	.023
Foreign experience	-.134**	.062
Working force hired	.009***	.004
Processing company product rejection	.135	.087
Decision maker/s in the family	-.017	.022
Used credit	-.285**	.142
Respondent activities in the mahalle	.157**	.068
Calling to Khashar in tomato production	.059	.069
Family other income	.063	.094
Treasure of the respondent	.048	.069
Constant	-.047	.245
Number of Observations	197	
Prob > F	0.0000	
Centered R2	0.4731	
Uncentered R2	0.7673	
Under identification test (Anderson canon. corr. LM statistic):	16.583	
Chi-sq(1) P-val	0.0000	
Weak identification test (Cragg-Donald Wald F statistic):	16.636	
Sargan statistic (overidentification test of all instruments):	0.000	
(the equation is exactly identified)		
Instrumented: Producer and buyer relationship		
Excluded instruments: Client came to buy the product		

Source: author's calculations based on questionnaire data * $p < 0.01$, ** $p < 0.05$, * $p < 0.1$**

Conclusion

1) In summarizing the results of this study, we return to the aim of this investigation. The aim was to study the state of economic relations between actors in the tomato production chain and measures to increase the income of smallholders. In addition, it focuses on the behaviour of smallholder farmers in trading partnerships and increasing their income in the tomato production chain. The regression results of our smallholder survey of the tomato growers in Samarkand Province, Uzbekistan, suggested that if the middleman has been familiar with the smallholder, it became clear that a social network between them would increase the desire to sell tomatoes to the intermediaries by 1.2 times. The analysis showed that customers who came to the farm gate to buy had a noticeable impact as an exogenous factor. Therefore, we identified this exogenous factor as an instrumental variable. Smallholders' primary family income increases the willingness of partnership with intermediaries by 19.1%, 0.9% hiring workers, and 15.7% active in the *mahalle*. It turned out that for those respondents who had many livestock animal

units, who had gained experience abroad, used financial loans in production, the desire to sell products directly to consumers increased by 34.4%, 13.4%, and 28.5%, respectively.

2) Thus, based on our analysis, it makes sense for smallholders to sell directly to consumers rather than intermediaries to generate more profit. Comprehensive research on this topic also looked at the supply of inputs to smallholders and formal trade agreements. Unfortunately, there were no participants in the tomato supply chain that had formal trade partnerships with smallholders.

3) Contractual relationship plays a crucial role in increasing the incomes of smallholders in the tomato production chain, reducing risks and transaction costs, and providing a guaranteed market and price. Unfortunately, for the comparative analysis, there was no agreement found between the participants on the supply of inputs and the purchase of products in the system of a small-scale production chain for the production of tomatoes.

4) Based on the findings, the government should support smallholder production and formal trade with direct consumers (processors, modern outlets, social institutions, and *dekhkan* markets) to generate income security. We concluded that they should contribute to the implementation of the agreements between actors in the chain.

Bibliography

1. Abebe, G.K., Bijman, J., Kemp, R., Omta, O. and Tsegaye, A. (2013), "Contract Farming Configuration: Smallholders' Preferences for Contract Design Attributes", *Food Policy*, Elsevier, Vol. 40, pp. 14–24.
2. Abebe, G.K., Bijman, J. and Royer, A. (2016), "Are Middlemen Facilitators or Barriers to Improve Smallholders' Welfare in Rural Economies? Empirical evidence from Ethiopia", *Journal of Rural Studies*, Elsevier Ltd, Vol. 43, pp. 203–213.
3. Bobojonov, I., Teuber, R., Hasanov, S., Urutyanyan, V. and Glauben, T. (2016), "Farmers' Export Market Participation Decisions in Transition Economies: a Comparative Study between Armenia and Uzbekistan", *Development Studies Research*, Taylor & Francis, Vol. 3 No. 1, pp. 25–35.
4. Boys, K.A. and Fraser, A.M. (2019), "Linking Small Fruit and Vegetable Farmers and Institutional Foodservice Operations: Marketing Challenges and Considerations", *Renewable Agriculture and Food Systems*, Cambridge University Press, Vol. 34 No. 3, pp. 226–238.
5. FAO, F. (2017), "The Future of Food and Agriculture—Trends and Challenges", *Annual Report*, FAO Rome, Italy, Vol. 296, pp. 1–180.
6. Feder, G., Just, R.E. and Zilberman, D. (1985), "Adoption of Agricultural Innovations in Developing Countries: A Survey", *Economic Development and Cultural Change*, University of Chicago Press, Vol. 33 No. 2, pp. 255–298.
7. Fischer, E. and Qaim, M. (2012), "Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya", *World Development*, Elsevier, Vol. 40 No. 6, pp. 1255–1268.
8. Geoffrey, S.K., Hillary, N.K., Kibe, M.A., Mariam, M. and Mary, M.C. (2014), "Challenges and Strategies to Improve Tomato Competitiveness Along the Tomato Value Chain in Kenya", *International Journal of Business and Management*, Canadian Center of Science and Education, Vol. 9 No. 9, p. 205.
9. Gomez y Paloma, S., Riesgo, L. and Louhichi, K. (2020), *The Role of Smallholder Farms in Food and Nutrition Security*, Springer Nature.
10. Good, I.J. (1963), "Maximum Entropy for Hypothesis Formulation, Especially for Multidimensional Contingency Tables", *The Annals of Mathematical Statistics*, Institute of Mathematical Statistics, Vol. 34 No. 3, pp. 911–934.
11. Hasanov, S., Sanaev, G. and Ganiev, I. (2014), "An Establishment of Agroclusters as a Key for the Development of Agro-Processing Industry in Uzbekistan".
12. de Jesus Salas-Mendez, E., Vicente, A., Pinheiro, A.C., Ballesteros, L.F., Silva, P., Rodríguez-García, R., Hernández-Castillo, F.D., et al. (2019), "Application of Edible Nanolaminate Coatings with Antimicrobial Extract of *Flourensia Cernua* to Extend the Shelf-life of Tomato (*Solanum Lycopersicum* L.) Fruit", *Postharvest Biology and Technology*, Elsevier, Vol. 150, pp. 19–27.
13. Krishnan, P. and Sciuabba, E. (2009), "Links and Architecture in Village Networks", *The Economic Journal*, Oxford University Press Oxford, UK, Vol. 119 No. 537, pp. 917–949.
14. Lee, J., Gereffi, G. and Beauvais, J. (2012), "Global Value Chains and Agrifood Standards: Challenges and Possibilities for Smallholders in Developing Countries", *Proceedings of the National Academy of Sciences*, National Academic Sciences, Vol. 109 No. 31, pp. 12326–12331.
15. Masters, A. (2008), "Unpleasant Middlemen", *Journal of Economic Behaviour & Organization*, Elsevier, Vol. 68 No. 1, pp. 73–86.
16. Meemken, E.-M. and Bellemare, M.F. (2020), "Smallholder Farmers and Contract Farming in Developing Countries", *Proceedings of the National Academy of Sciences*, National Academic Sciences, Vol. 117 No. 1, pp. 259–264.

17. Muratov, S.A. (2021a), "Economic Assessment of Factors Affecting the Decision of Households to Engage in Non-farm Activities", *Irrigation and Melioration*, Vol. 2021 No. 2, pp. 38–43.
18. Muratov, S.A. (2021b), "The Economic Assessment of Factors Affecting Small Household (tomorka) in Rural Areas and Their Income", *Irrigation and Melioration*, Vol. 2021 No. 3, pp. 45–51.
19. Neven, D. (2014a), *Developing Sustainable Food Value Chains*, FAO.
20. Nylund, K.L., Asparouhov, T. and Muthen, B.O. (2007), "Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modelling: A Monte Carlo Simulation Study", *Structural Equation Modelling: A Multidisciplinary Journal*, Taylor & Francis, Vol. 14 No. 4, pp. 535–569.
21. Otsuka, K., Nakano, Y. and Takahashi, K. (2016), "Contract Farming in Developed and Developing Countries", *Annual Review of Resource Economics*, Annual Reviews, Vol. 8, pp. 353–376.
22. Parдав, K. (2021), "Smallholders Preferences for Contract Design Attributes, A Case of Samarkand Province", *Economics and Education*, No. 5, pp. 59–66.
23. Parдав, K. and Hasanov, S. (2020), "Theoretical Bases of Improving Economic Relations Between the Subjects of the Food Production Chain", *Journal of Agro-Ecosystems*, Vol.1(15), pp. 68-71.
24. Ranjan, R. (2017), "Challenges to Farm Produce Marketing: A Model of Bargaining Between Farmers and Middlemen Under Risk", *Journal of Agricultural and Resource Economics*, JSTOR, pp. 386–405.
25. Reardon, T., Echeverria, R., Berdegue, J., Minten, B., Liverpool-Tasie, S., Tschirley, D. and Zilberman, D. (2019), "Rapid Transformation of Food Systems in Developing Regions: Highlighting the Role of Agricultural Research & Innovations", *Agricultural Systems*, Elsevier, Vol. 172, pp. 47–59.
26. Rudenko, I. (2008), "Value Chains for Rural and Regional Development: The Case of Cotton, Wheat, Fruit and Vegetable Value Chains in the Lower Reaches of the Amu Darya River, Uzbekistan", Hannover: Gottfried Wilhelm Leibniz Universität Hannover.
27. Saitone, T.L. and Sexton, R.J. (2017), "Agri-food Supply Chain: Evolution and Performance with Conflicting Consumer and Societal Demands", *European Review of Agricultural Economics*, Oxford University Press, Vol. 44 No. 4, pp. 634–657.
28. Sanaev, G., Kim, K.R., Hasanov, S. and Ganiev, I. (2015), "Review of Postharvest Aspects of Fruits and Vegetables Subsector in Uzbekistan", *Connecting Local and Global Food for Sustainable Solutions in Public Food Procurement*, Vol. 14, p. 557.
29. Simmons, P. (2002), "Overview of Smallholder Contract Farming in Developing Countries".
30. World Health Organization. (2020), *The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets*, Vol. 2020, Food & Agriculture Organization.