MEASURING AGRICULTURAL PRODUCTION DIVERSITY WITH THE REFERENCE SAMARKAND REGION

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Abstract: *This investigation is examined agricultural production diversification in a given period and space by a single quantitative indicator. For the analyses conducted the survey in the Samarkand region, which areas produced the major agricultural products. The results indicated that crop diversification was high at a value of 0.76 measured by Herfindahl Hirschman index in Samarkand region. The level of livestock diversification is determined very low at value of 0.15. Government support for livestock diversification will serve to increase rural households' income and increase the consumption and production of high-calorie products.*
Keywords: *Crop diversification, Livestock diversification, Herfindahl Hirschman Index, Household, Samarkand region.*

Introduction. In the first years of independence, Uzbekistan was considered an agrarian country because the main production of the economy was strongly related to agriculture. In recent years the share of agriculture in GDP has declined due to the rapid growth of other sectors of the economy. At the same time, structural changes have taken place in agriculture, and the types of agricultural enterprises have also changed radically. State and collective farms have been replaced by private farmers and dehqons(households) as the main producers of agricultural products[1].Private farms mainly produce a state-ordered strategic products cotton and wheat in large areas of plots. Dehqons mainly use land plots as backyard kitchen gardens and are free to choose their crops to plant and to sell at their demands. Besides more than 90 percent of meat and milk and 60 percent of eggs produced by dehqons in 2020. It means dehqons are highly engaged in animal husbandry. Still, dehqon farmers have a too-small land size to generate profits at a scale that would negate the need to generate additional income via other means. Recently, "The agricultural development strategy of the Republic of Uzbekistan for 2020 – 2030" has been adopted as a legal framework and roadmap for sustainable agricultural development in the country[2]. The main and first toward of the strategy is to ensure food security of the population. Promote healthy consumption, intensify and diversify the production of agricultural products, increase productivity in livestock, conduct research aimed at sustainable intensification of production of fish and poultry, as well as milk production were set as main the priority direction of the strategy. Accordingly, exploration and evaluation of the agricultural production diversification of private and dehqon farms play an important role in the performance of these tasks.

Crop diversification in narrow meaning is understood as dividing the land into smaller units for the different crops at the household level[3]. Consequently, crop diversification is considered a desired strategy for minimizing the risks of smallholder farmers to sustain their food stocks and incomes. Because small farmers are more vulnerable to the overall effects of climate change since they have limited resources to invest in expensive coping strategies[4]. At the national level crop diversification is a viable option to maximize the rational use of land, water, and other resources and for the overall agricultural development in the country[5]. To sum up, crop diversification improves food security and consumption diversity, increases soil fertility with higher yields, introduction of digital technologies in the social sphere, reduces pests in terms of ecology and enhances rational use of natural resources, and minimizes income risks.

Scientists Bobojonov and Hasanov have carried out an investigation on crop diversification in the case of Uzbekistan[6] [7]. Although the available literature on agricultural diversification has been disclosed, only crop diversification has been identified at the level of private farms[8]. However, livestock diversification has not been considered. This paper assesses the current condition of crop and livestock diversification at the household level using measurements of diversification.

Research methodology. The study was conducted in Samarkand region which is major agricultural area in Uzbekistan. Agricultural production was the highest (12.9 percent) in this region in 2020. Survey data was collected through face-to-face interviews with respondents from the beginning of January to the end of March in 2021. Total of 328 respondents were randomly selected in nine districts (Akdarya, Bulungur, Ishtixan, Jomboy, Kushrabad, Payarik, Pa sdargom,Taylak, Urgut) of Samarkand region.

The study will examine agricultural production diversification in a given time and space by a single quantitative indicator. Different types of indices have been used in the literature to measure agricultural production diversification. [9] The magnitude of diversification can be measured several statistical tools which include Simpson Index, Entropy Index, Shannon Index, Ogive Index, Composite, Herfindahl-Hirschman Index, etc[10].

Herfindahl-Hirschman Index, is the most popular method in economics to measure the market concentration [11]. Previous studies have been used to measure crop diversification[12] [13] [14], only a few studies applied to measure livestock diversification [15] [16]. In this paper, to measure the extent of agricultural diversification (HHI) was applied. Using the equation below, the index (Ht) was calculated such as

$$H_t = 1 - \Sigma(S_{it})^2 \quad (1)$$

Sit has denoted the share of i crop in total planted area in the year 't'. From the point of view livestock diversification index Sit represents the share of i livestock type in total number of livestock then applied to calculate the diversification index[16]. This index bounds between zero and one value. Higher is the value of the index, the larger is the degree of diversification. The index provides only the magnitude of diversification, and not its nature or direction. Based on the literature review the level of crop and livestock diversification were classified as shown in

Table 1.[16]

Results and discussions Based on survey results, total

Table 1.

Category of agricultural production diversification based on value

Diversity index range	
Crop	Livestock
High 0.7<x	High 0.75 < x
Medium 0.4 < x ⩽ 0.7	Medium 0.45 < x ⩽ 0.75
Low x ⩽ 0.4	Low x ⩽ 0.45

Results and discussions Based on survey results, total of 49 types of crops were grown on the farms. In terms of diversification, the result indicated that the average crop diversification index within the sample of households was 0.76 with a standard deviation of 0.12.(Figure 1) By districts Bulungur, Jambay, Ishtikhan, Akdarya, Pastdargom and Payariq districts are highly diversified, while Kushrabat, Taylak and Urgut districts are moderately diversified in crop and conversely all districts are low diversified in livestock except Kushrabat district. Kushrabat district is moderately diversified (Table 2). Several studies found out livestock diversification in small farms, cattles are seen as the expensive assets and usually spend to build house or to hold weddings and other events and is noted that in terms of revenue and food security livestock diversification especially small ruminants like sheep, goats and poultry require small investments, can quickly multiply, are easily convertible to cash in a short time, and are quickly turn into a high-calorie food to constituting an essential coping strategy[17]. Also, livestock diversification is considered the most optimal coping strategy in crop failure due to adverse weather conditions and negative climate change effects[18]. In this study livestock portfolios disaggregate into poultry (chicken, fowl, duck, turkey), small ruminants (goats and sheep), small non-ruminant livestock (rabbits and swine), cattle (cows, bulls, heifers, calves). In terms of livestock diversification, the result indicated that the average value of the index within the sample of households was 0.15 with a standard deviation of 0.22. (Figure 2).

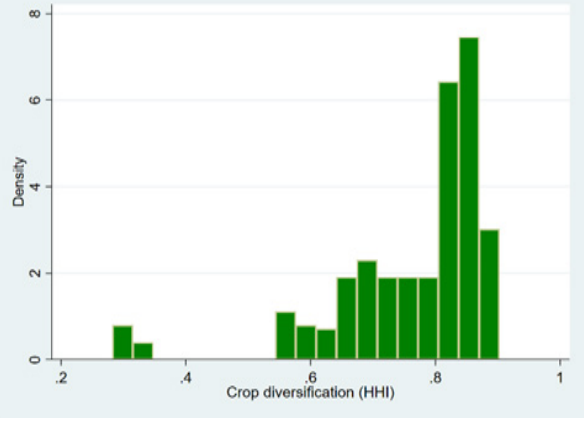

Figure 1. The mean crop diversification index in study areas. Source: Own estimation based on survey data

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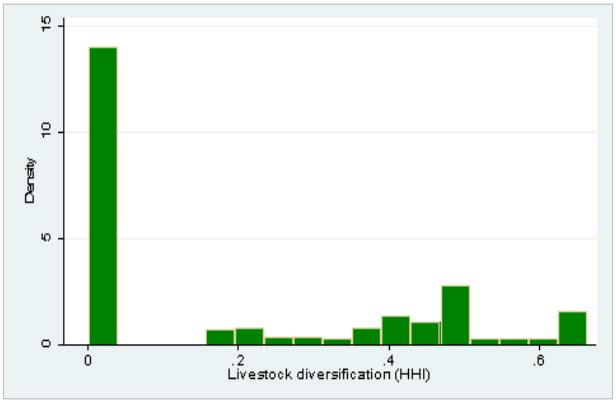

Figure 2. The mean livestock diversification index in study areas. Source: Own estimation based on survey data.

Conclusion. To conclude Agricultural production diversification considered as an effective strategy which can help contribute to improved yield for the small dehqon farms which will translate to more and a variety of food for consumption, accumulate stocks of products with reduced seasonality and minimize the risks of selling surplus. The results indicated that in Samarkand region, crop diversification was high at a value of 0.76 measured by Herfindahl Hirschman Index. The level of livestock diversification is very low at value of 0.15. Government support for accessing effective livestock extension services and livestock input markets, develop and increase forage production both intensively and extensively promotes livestock diversification which will serve to increase rural households' income and increase the consumption and production of high-calorie products. Besides, group-based approaches enhance activity of dehqon farms associations can help promote livestock diversification especially through learning and teaching each other, multiplication and sharing of livestock among dehqon farmers in terms of marketing.

Table 2

Descriptive statistics of level of agricultural production diversification in study areas

District name	Obs	Crop diversification		Livestock diversification	
		Mean	Std. Dev	Mean	Std. Dev
Bulungur	22	0.85	0.19	0.29	0.22
Ishtikhan	42	0.81	0.08	0.07	0.15
Jambay	21	0.81	0.06	0.18	0.21
Akdarya	38	0.77	0.08	0.05	0.15
Pastdargom	17	0.80	0.08	0.17	0.25
Payarik	28	0.75	0.06	0.07	0.17
Kushrabat	14	0.68	0.09	0.48	0.11
Taylak	77	0.66	0.17	0.16	0.24
Urgut	69	0.50	0.28	0.14	0.20

The households in the study areas were low diversified in their livestock rearing. The survey results show that in Samarkand region households shifted towards more crop diversification than livestock diversification.

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