The Importance of the High – Tech Land Cultivation for Increasing the Profitability of the Self – Employed Farmers in Georgia

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Abstract

The research purpose is to study the impact of the new technologies on the self-employment productivity in the agricultural sector of Georgia, which implies an increase in the growth rate of the produced products in a certain period of time. The purpose of the topic stems from the fact that in the agricultural sector of Georgia, only self – employed farmers produce products at their exploit costs and risks, because of that clustering of the agricultural sector has not yet occurred and state institutions do not finance R&D expenditures, which reduces the ability to access new technologies and productivity of the self – employment farmers.

Georgia is a post-Soviet country that, after leaving the Soviet Union, experienced wars, civil strife and the destruction of the economy, the consequences of which the population of Georgia is still struggling with. The agriculture sector is the only source of the income for 20% of the population and therefore it is very important to promote this sector. Agriculture is associated with the costs of the use of agricultural machinery, fuel, fertilizers and chemicals, which farmers have to pay only from their exploit funds.

Key Words: Self – Employment, Profitability, Automatization, R&D Expenditures.

Introduction

The latest reports of the European Cluster Cooperation Platform provide information on the growing trends in the implementation of the digital technologies in agricultural sector, which is manifested in the automatization and robotization of the agricultural machinery and other types of heavy machinery for agricultural purpose, also, transportation vehicles and devices, those are necessary for agricultural activities (Marinoudi, Lampridi, Kateris, Pearson, Grøn Sørensen & Bochtis 2021). In addition, cluster development economic policies diversify the costs (including fuel) of the agricultural activities and farmers earn more profit due to the difference between income and expenditure (Delgado & Siamwalla 1999). During the period of the Soviet Union, Georgian agriculture occupied a leading position with the pioneers of industrialization. Collective farms took care of the necessary measures to increase the volume of harvest and received appropriate support from the state, however, after the collapse of the Soviet Union, the situation changed radically. These changes were reflected in the industrialization indicators, such as: availability of the agricultural machinery and other types of heavy machinery for agricultural purpose, also, transportation vehicles and devices, also, in the diversification of the expenditures related to the agricultural activities. Within the framework of the research, the statistical correlation of the main characteristics of agricultural activity in Georgia will be studied in the absence of the cluster development programs, which is the reason why the exploitation of Soviet equipment in the agricultural sector is still noticeable in Georgia.

1. Research Audience and Questionnaire

Based on the objectives of the research, Shida Kartli region was selected as the research area, which is an outstanding region in terms of favorable natural conditions for agriculture. The research was conducted by the direct survey method and 503 participants were interviewed. All of them have been settled in the rural areas and are self-employed. The survey was carried out by

the method of random selection of one participant from one household. The questionnaire was filled by 214 males and 289 females of all age categories. The interviewees included participants with school, college, and higher education.

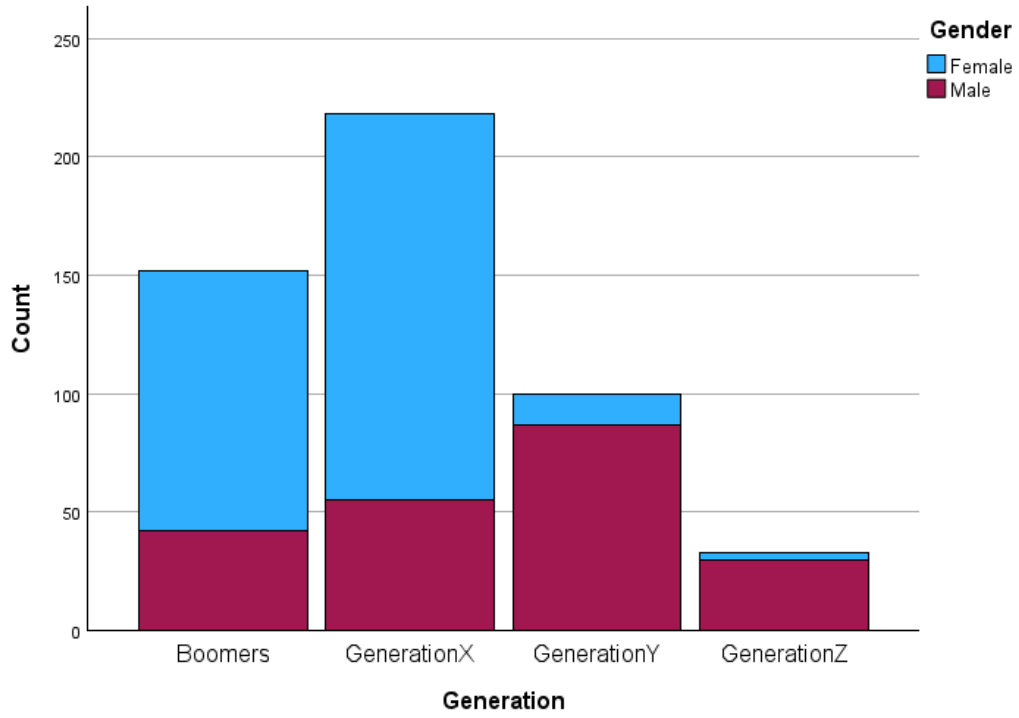
Table 1.

Generation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Boomers	152	30,2	30,2	30,2
	Generation X	218	43,3	43,3	73,6
	Generation Y	100	19,9	19,9	93,4
	Generation Z	33	6,6	6,6	100,0
	Total	503	100,0	100,0	

Source: Author's compilation using by SPSS program

Figure 1.



Source: Author's compilation using by SPSS program

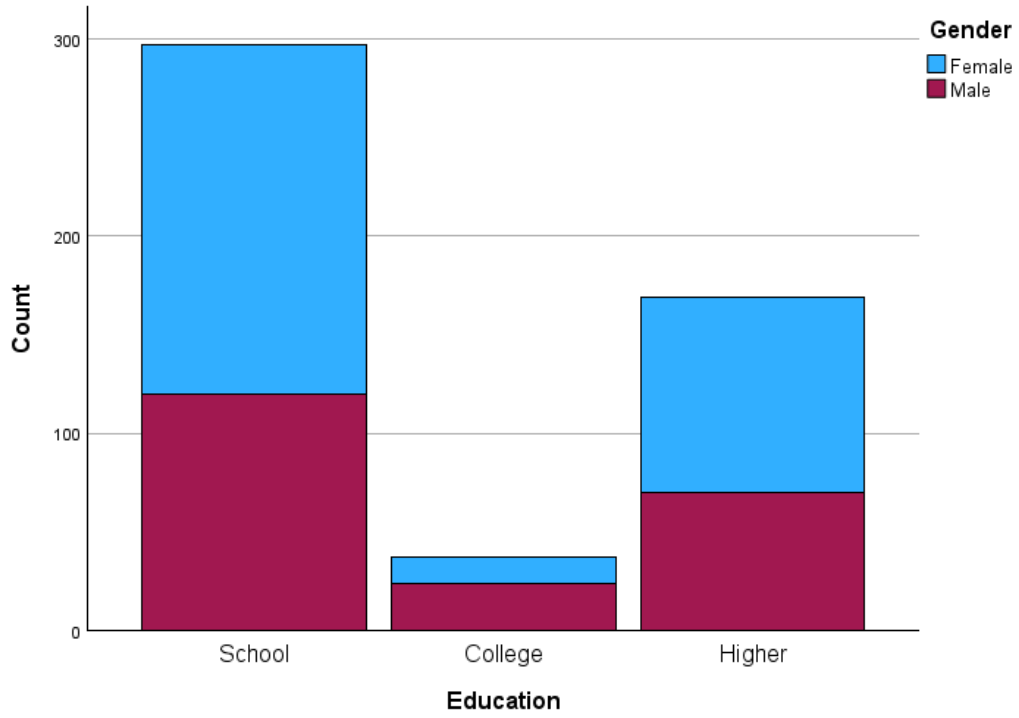
Table 2.

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	School	297	59,0	59,0	59,0
	College	37	7,4	7,4	66,4
	Higher	169	33,6	33,6	100,0
	Total	503	100,0	100,0	

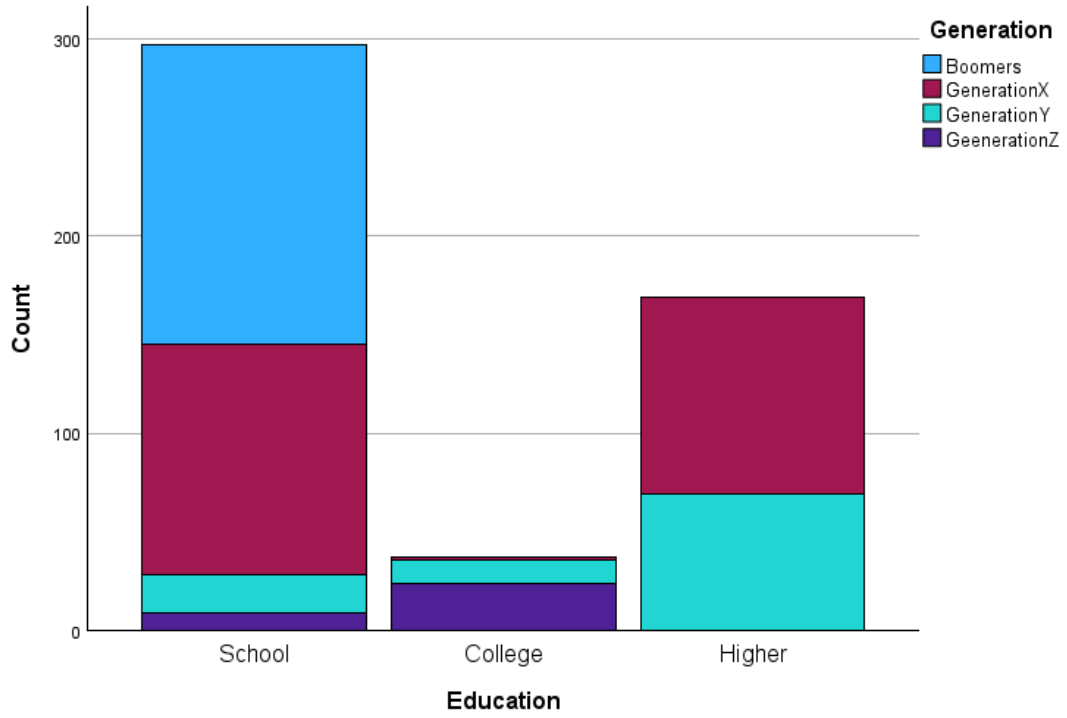
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Figure 2.



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Figure 3.



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The participants answered 5 questions about the variables of the agricultural activities. The main variables are: agricultural purpose property, income volume, fuel consumption expenditure, fertilizers & chemicals consumption expenditures and amount of the crop, which is defended on the land cultivation and plant care. The questionnaire contained the questions, those were formulated like this:

- ***Q 1:*** *Are you able to exploit any kind of the agricultural purpose property?*
- ***Q 2:*** *How much amounts your income volume per month?*
- ***Q 3:*** *How much amounts your fuel consumption volume per month?*
- ***Q 4:*** *How much amounts your fertilizers & chemicals consumption volume per month?*
- ***Q 5:*** *What is the amount of the crop from the 0,1ha land area?*

The answers about these questions are presented in the research results.

2. Research Results

2.1. Exploitation of the Agricultural Purpose Property

Based on the data obtained as a result of the research, it is possible to assess the industrialization level of the agricultural sector according to the agricultural purpose property exploited by the surveyed participants. The agricultural purpose property, those are exploited by the participants contains: agricultural machinery and other types of heavy machinery for agricultural purpose, also, transportation vehicles and devices.

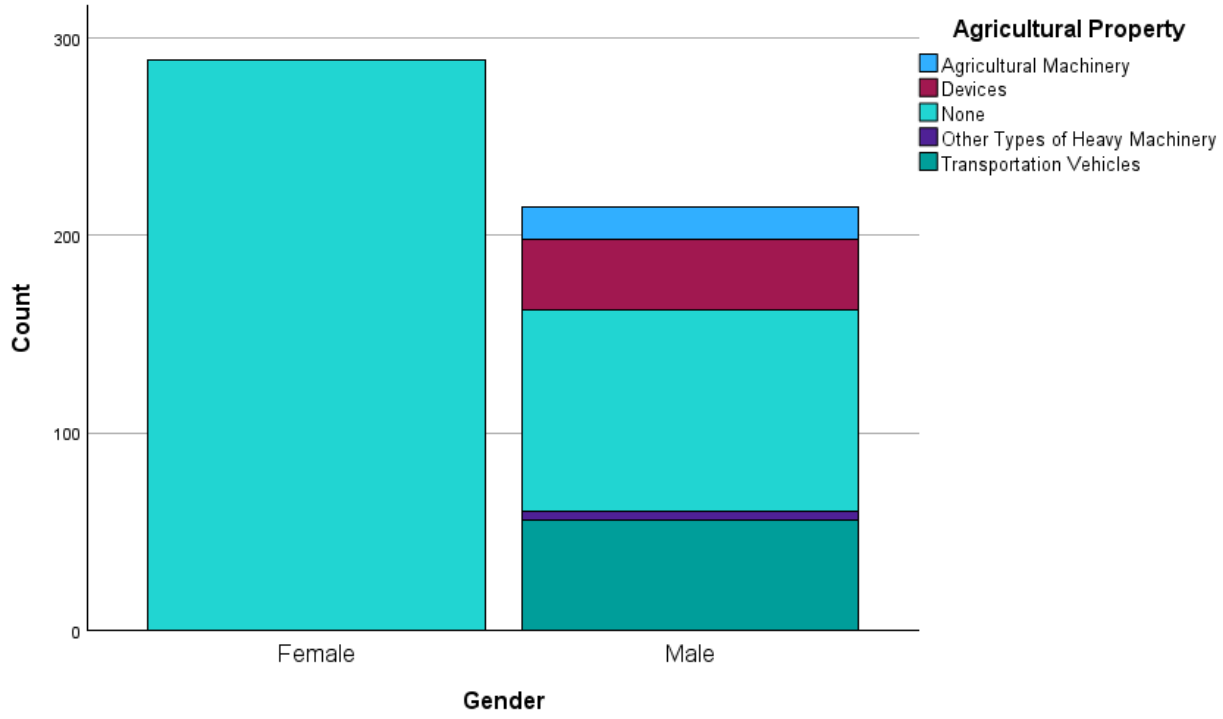
Table 3.

Agricultural Purpose Property

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agricultural Machinery	16	3,2	3,2	3,2
	Devices	36	7,2	7,2	10,3
	None	391	77,7	77,7	88,1
	Other Types of Heavy Machinery	4	,8	,8	88,9
	Transportation Vehicles	56	11,1	11,1	100,0
	Total	503	100,0	100,0	

Source: Author's compilation using by SPSS program

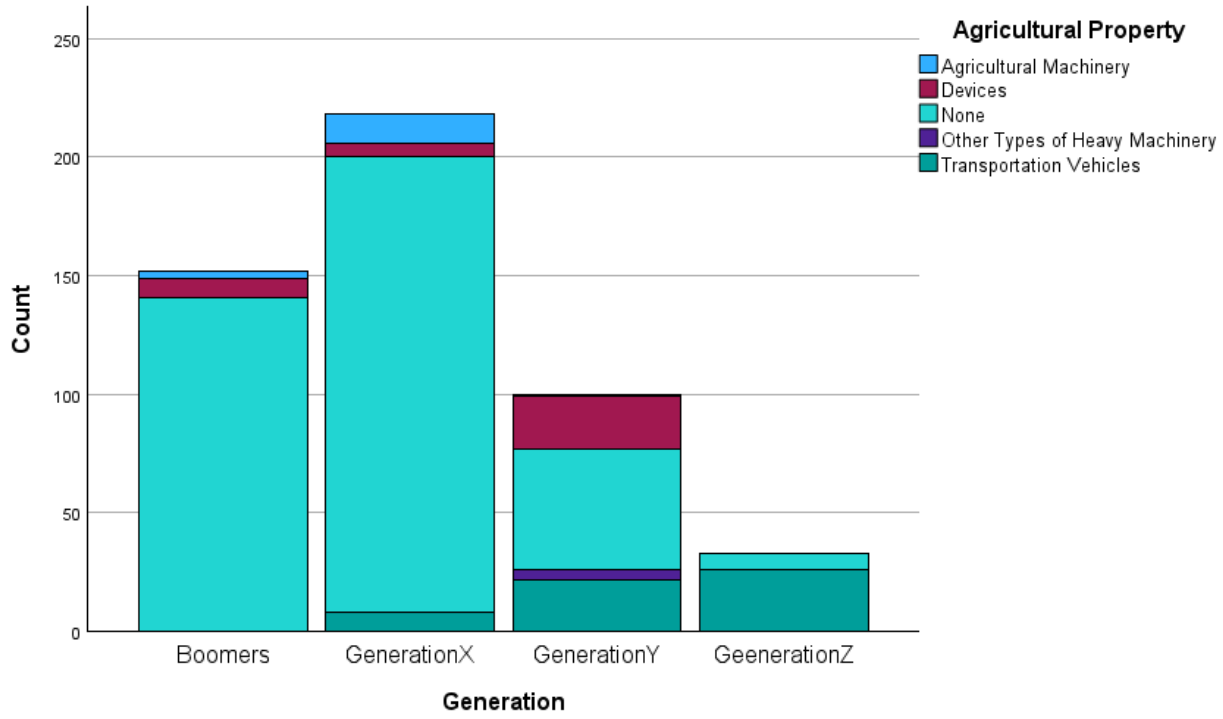
Figure 4.



Source: Author's compilation using by SPSS program

All of those properties have been exploiting only by the male participants, because females do not have enough qualifications and skills for exploiting agricultural purpose property. They only apply manual work, which is the basement for gender inequality in the agricultural sector of Georgia. The most of the answers (just 77,7 %), which are about ***Q 1:*** *Are you exploiter of any kind of the agricultural purpose property?* is negative answers, which means that only 22,3 % of the participants have availability. That means, that there is very small amount of the agricultural purpose property in Shida Kartli region of Georgia.

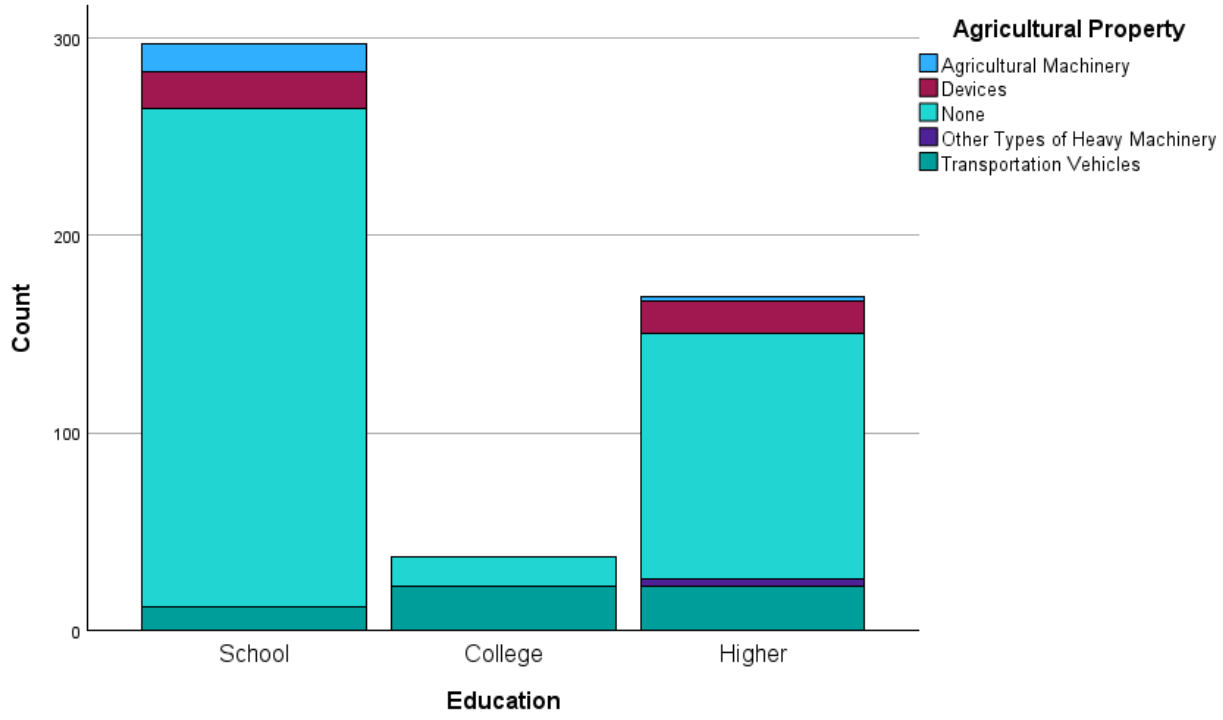
Figure 5.



Source: Author's compilation using by SPSS program

The most part of the negative answers belongs to participants, those present Boomers and Generation X. Although, the exploiters of the agricultural machinery are only Generation X representatives. The representatives of the Generation Y exploit all kind of agricultural purpose property, also some of them has fixed negative answers. The representatives of the Generation Z exploit only transportation vehicles, also some of them has fixed negative answers.

Figure 6.



Source: Author's compilation using by SPSS program

The most part of the negative answers belongs to participants, who have school and higher education, because the most part of the participants belongs to school and higher education groups. The share of the all kind of the agricultural purpose property is almost equal in the all kind of the education groups, however agricultural machinery is mostly exploited by school education participants group. The results of the research show that exploitation of the agricultural purpose property does not depend on professional and higher education, and in Georgia, it does not take into account the requirements for special qualifications and skills.

2.2. Profit and Crop

The difference between income and expenditures determines the amount of self-employed profit. The self-employed farmers' incomes from agricultural activities were determined based on the multiplying of the output volume of the harvested crop and the price of the harvested crop. In the study, any kind of crops, such as vegetables and cereals, which self-employed people get for every 0.1 ha of land, is taken into account.

Table 4.

Income Volume

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	225 to 270 Euro	97	19,3	19,3	19,3
	271 to 335 Euro	91	18,1	18,1	37,4
	336 to 405 Euro	100	19,9	19,9	57,3
	406 to 470 Euro	100	19,9	19,9	77,1
	more than 471 Euro	115	22,9	22,9	100,0
	Total	503	100,0	100,0	

Source: Author's compilation using by SPSS program

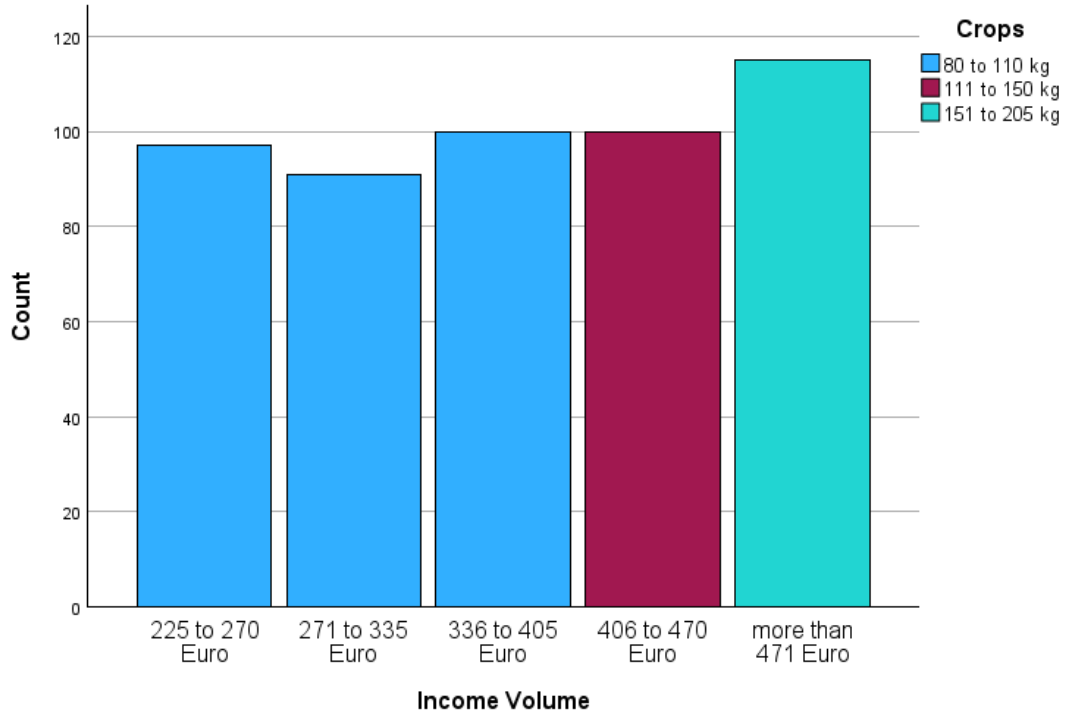
Table 5.

Crop

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	80 to 110 kg	288	57,3	57,3	57,3
	111 to 150 kg	100	19,9	19,9	77,1
	151 to 205 kg	115	22,9	22,9	100,0
	Total	503	100,0	100,0	

Source: Author's compilation using by SPSS program

Figure 7.



Source: Author's compilation using by SPSS program

The participants, who get 80 to 110 kg amount of the crop on the 0.1 ha land area, have 225 to 405 Euro income volume per month and the participants who get 111 to 150 kg amount of the crop, have 406 to 470 Euro income volume per month. More than 471 Euro income volume per month have the participants, who gets 151 to 205 kg amount of the crop. However, to define the volume of the profit, it was necessary to study expenditures.

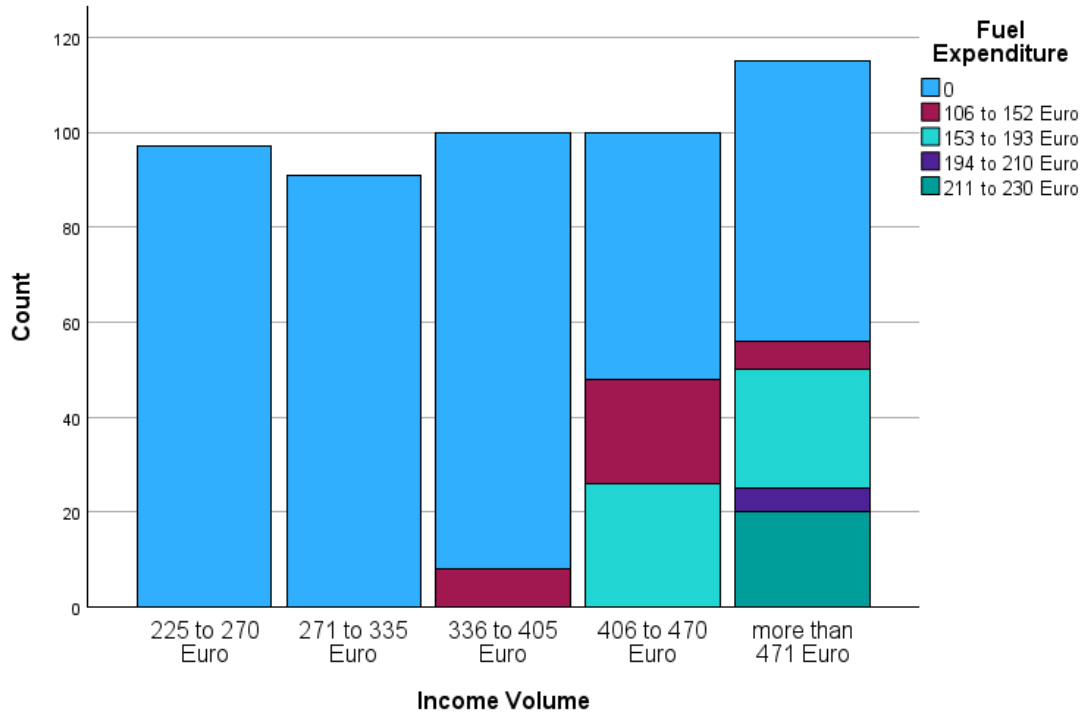
Table 6.

Fuel Consumption Expenditure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	391	77,7	77,7	77,7
	106 to 152 Euro	36	7,2	7,2	84,9
	153 to 193 Euro	51	10,1	10,1	95,0
	194 to 210 Euro	5	1,0	1,0	96,0
	211 to 230 Euro	20	4,0	4,0	100,0
	Total	503	100,0	100,0	

Source: Author's compilation using by SPSS program

Figure 8.



Source: Author's compilation using by SPSS program

It had been considered, that the participants, who do not exploit agricultural purpose property have not any fuel consumption expenditure. Their income volume per month amounts from 225 to 335 Euro. Also, there are some participants, who have more than 471 Euro income volume per month, but do not exploit agricultural purpose property, that means manual work and fertilizers and chemicals consumption have significant efficiency.

Table 7.

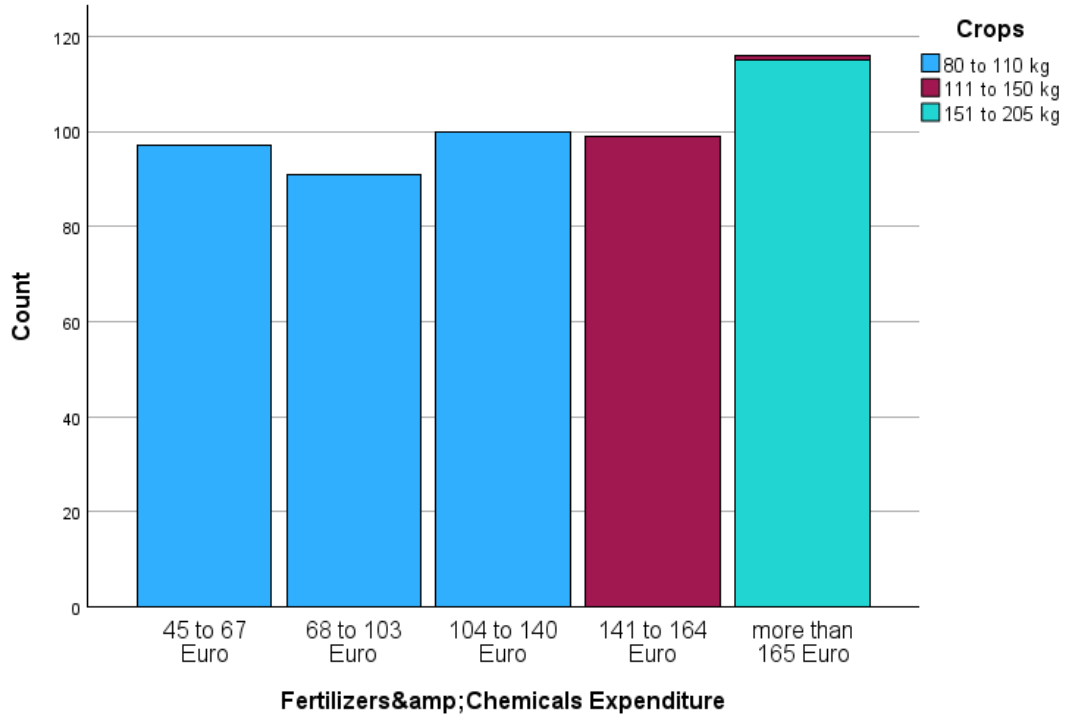
Fertilizers & Chemicals Consumption Expenditure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	45 to 67 Euro	97	19,3	19,3	19,3
	68 to 103 Euro	91	18,1	18,1	37,4
	104 to 140 Euro	100	19,9	19,9	57,3

141 to 164 Euro	99	19,7	19,7	76,9
more than 165 Euro	116	23,1	23,1	100,0
Total	503	100,0	100,0	

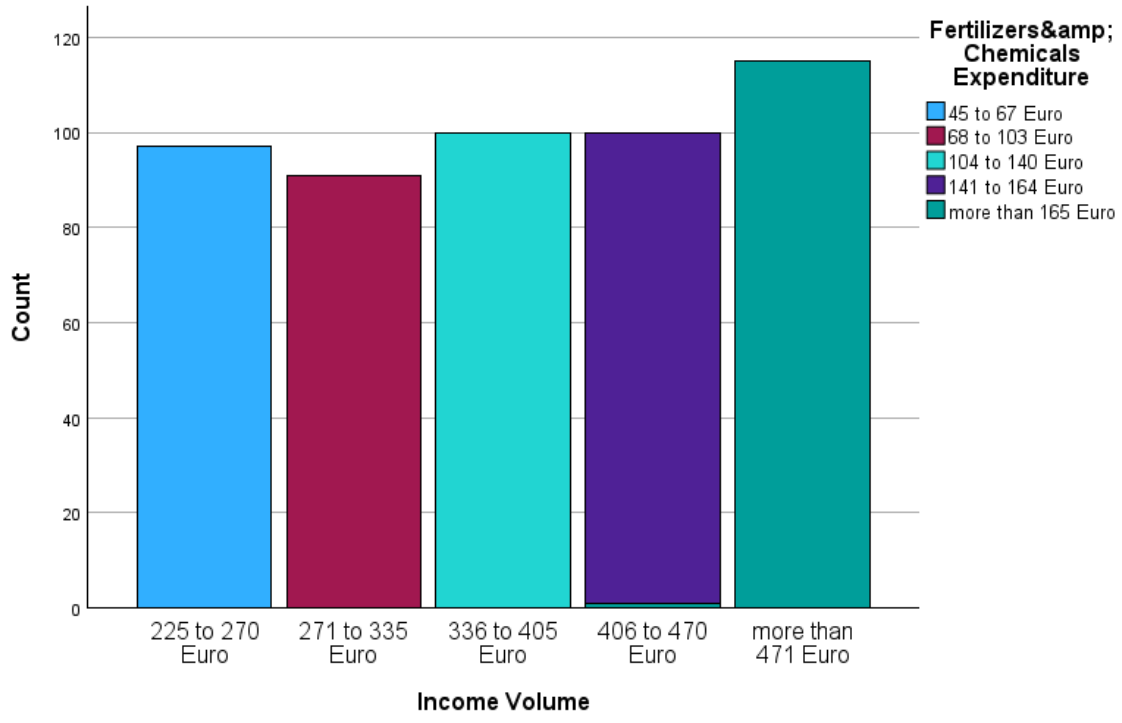
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Figure 9.



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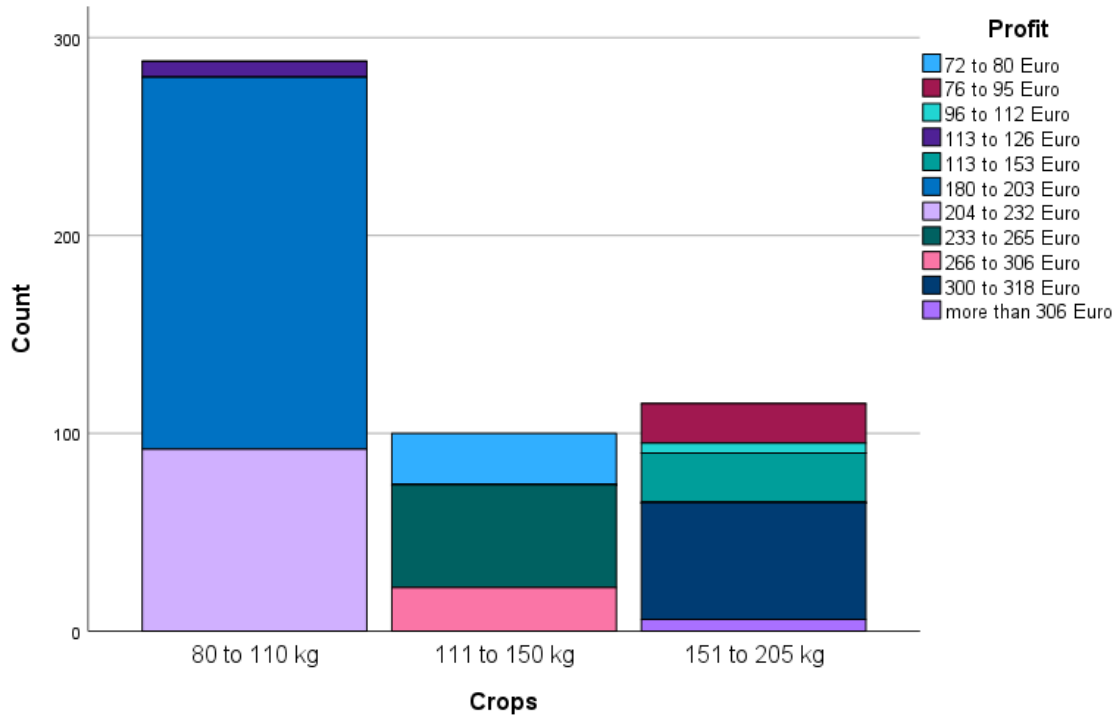
Figure 10.



Source: Author's compilation using by SPSS program

The study shows, that the participants, who have the highest volume of the fertilizers & chemicals consumption expenditure, also have the highest volume of incomes, because of the amount of the crop. According to the research results, it can be considerable that fertilizers & chemicals consumption expenditure defines the productivity of the self-employment in the agricultural sector of Georgia and for the increasing the productivity, fertilizers & chemicals consumption volume must be increased. However, the volume of the harvested crop does not determine the volume of profit, because the volume of profit depends on the costs incurred in growing the crop. In these costs, the costs of land cultivation and plant care, including the consumption of fuel, fertilizers and chemicals, should be taken into account.

Figure 11.



Source: Author's compilation using by SPSS program

As it can be seen from the diagram, the volume of the profit is from 72 Euro to 318 Euro. The participants, who exploit the agricultural purpose property, also, have fuel consumption expenditures with fertilizers & chemicals consumption expenditures. The participants, who do not exploit the agricultural purpose property do not have fuel consumption expenditures. However, fertilizers & chemicals expenditures have all of the participants.

3. Development of the Hypothesis

The purpose of the research, is to study the Importance of the High – Tech Land Cultivation for Increasing the Profitability of the Self – Employed Farmers in Georgia, which is depend on the automatization and robotization, because there is very limited amount of the agricultural purpose property and female self – employees are not able to exploit old internal combustion engine agricultural purpose property. In this condition, it can be considered null and alternative hypothesis, which might be presented in the following form.

- ***Null Hypothesis*** H_0***:*** *Female self – employees' average profit volume is equal to the male self – employees' average profit volume in the agricultural sector of Georgia*
- ***Alternative Hypothesis:*** H_{a1}***:*** *Male self-employees have higher profit volume than female self-employees in the agricultural sector of Georgia.*
- ***Alternative Hypothesis:*** H_{a2}***:*** *Male self-employees have lower profit volume than female self-employees in the agricultural sector of Georgia.*

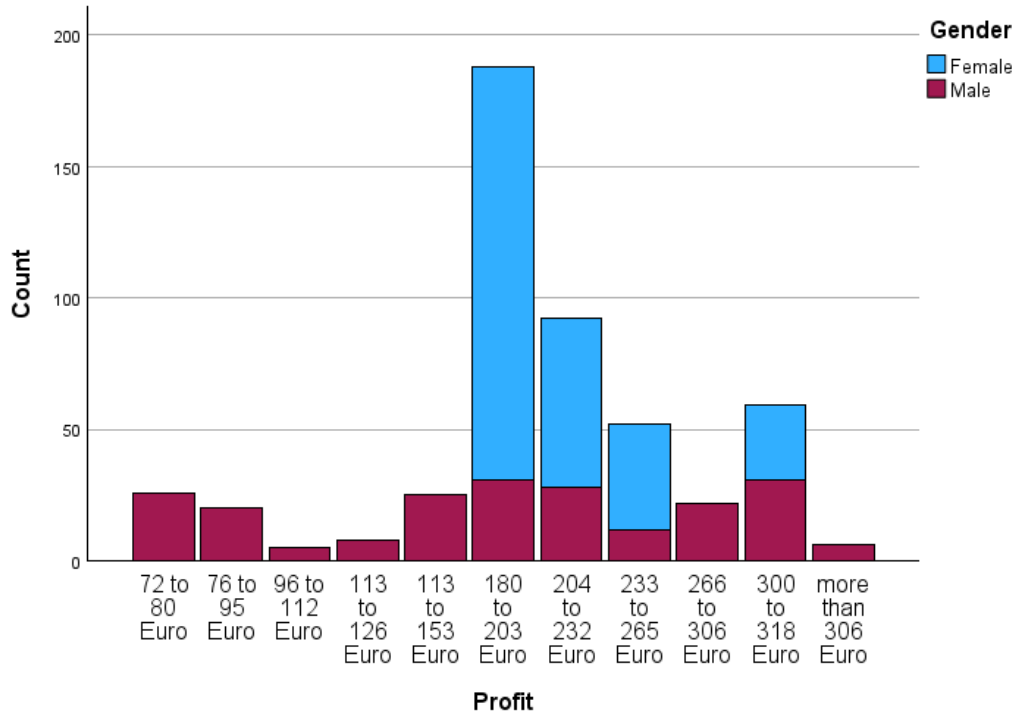
Automatization and robotization means, to eliminate fuel consumption expenditures and optimize fertilizers & chemicals consumption volume. As a result of the discussion of the hypotheses, it is possible to study the importance of the automatization and robotization in the direction of the involvement of the female self-employed in high-tech agricultural activities.

4. Data Analysis

In order to determine the correlation between gender and the volume of the profit, it is necessary to consider separately the correlation between the agricultural purpose property and the volume

of profit. The exploitation of different types of agricultural property is associated with different magnitudes of the fuel consumption expenditures. Although, in case of the female self – employees it does not take place the fuel consumption. Also, the same statement will be maintained in case of the male self – employees, who exploit agricultural purpose property, under conditions of automatization and robotization.

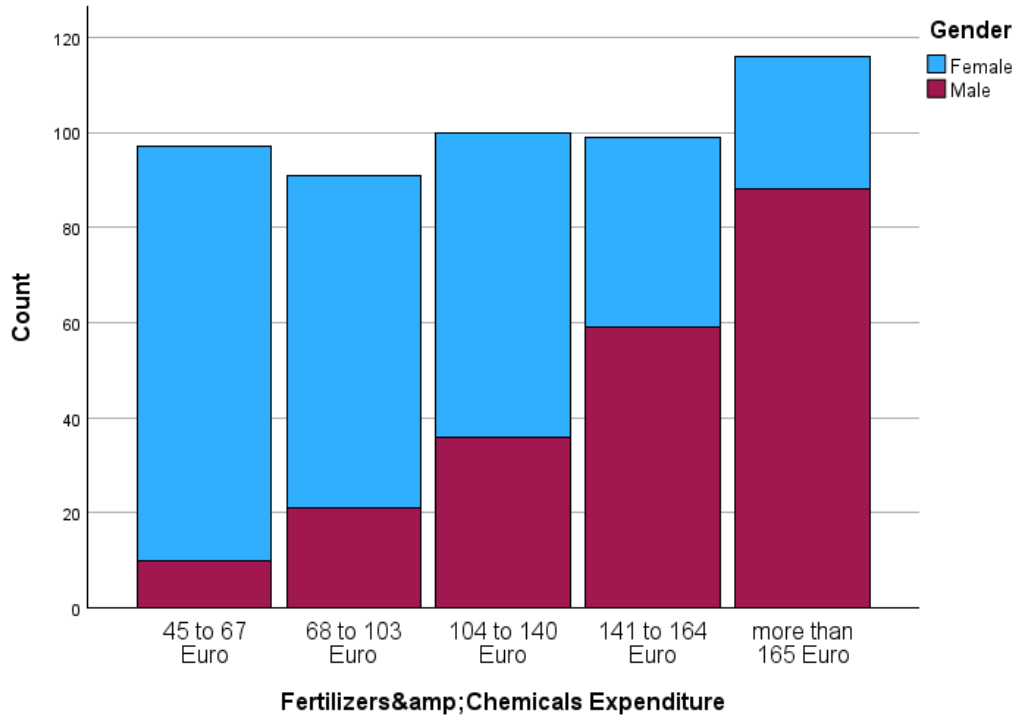
Figure 12.



Source: Author's compilation using by SPSS program

The most of the female self – employees have profit volume from 180 to 203 Euro. The highest profit volume, which the female self – employees have is 318 Euro. They apply only manual work, but they use fertilizers & chemicals for the plant care.

Figure 14.



Source: Author's compilation using by SPSS program

In case of the female self – employees, the fertilizers & chemicals consumption expenditure is less than in case of the male self – employees, which affects the profit volume. Also, if male self – self employees would not have fuel consumption expenditures, their profit volume will be higher. In this condition, in order to consider ***Null Hypothesis H*** $_0$***:*** *Female self – employees' average profit volume is equal to the male self – employees' average profit volume in the agricultural sector of Georgia*, it could be used Independent – Samples T Test.

T Test

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Profit	Female	289	6,89	1,243	,073
	Male	214	6,03	3,058	,209

Source: Author's compilation using by SPSS program

Note: Recoding variable function had been used for statistical analysis and the key table is presented below.

Key Table for Recoded Values

VALUES	***LABLES***
1	*72 to 80 Euro*
2	*76 to 95 Euro*
3	*96 to 112 Euro*
4	*113 to 126 Euro*
5	*113 to 153 Euro*
6	*180 to 203 Euro*
7	*204 to 232 Euro*
8	*233 to 265 Euro*
9	*266 to 306 Euro*
10	*300 to 318 Euro*
11	*more than 306 Euro*
12	*more than 319 Euro*

Source: Author's compilation using by SPSS program

Independent – Samples T Test group statistics shows, that in case of the female self – employees, the mean of the profit volume amounts 6,89. In the kay table, 180 to 203 Euro is the appropriate

value for 6,89. Because the integer value defines the profit volume group. In case of the male self – employees, the mean of the profit volume amounts 6,03. In the kay table, 180 to 203 Euro is the appropriate value for 6,03. According to group statistics, it can be concluded, that female self – employees' average profit volume is equal to the male self – employees' average profit volume in the agricultural sector of Georgia, despite the fuel consumption expenditures.

Independent Samples Test

		Levene's Test for Equality of Variances		***t-test for Equality of Means***							
						Significance			***Std.***	***95% Confidence Interval of the***	
		F	***Sig.***	***t***	***df***	***One - Side***	***Two - Side***	***Mean Difference***	***Error Difference***	***Lower***	***Upper***
Profit	***Equal variances assumed***	***182,547***	***<,001***	***4,313***	***501***	***<,001***	***<,001***	***,858***	***,199***	***,467***	***1,249***
	Equal variances not assumed			***3,873***	***265,400***	***<,001***	***<,001***	***,858***	***,221***	***,422***	***1,294***

Source: Author's compilation using by SPSS program

Note: The probability (sig. <,001) of falsely rejecting the null hypothesis is negligible, so it is possible to prove, that the null hypothesis is acceptable.

Independent Samples Effect Sizes

				95% Confidence Interval	
		Standardizer [a]	*Point Estimate*	*Lower*	*Upper*
Profit	*Cohen's d*	*2,206*	*,389*	*,210*	*,567*

Hedges' correction	*2,209*	*,388*	*,210*	*,566*
Glass's delta	*3,058*	*,281*	*,101*	*,459*

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

Source: Author's compilation using by SPSS program

According to the Independent Samples Effect Sizes, it can be seen, that Cohen's d is equal to the 0,389 and it is one another evidence, that null hypothesis is true, because the meaning of the Cohen's d, does not belongs to rejection area. Also, Hedges' correction is equal to the 0,388 and Glass's delta is equal to the 0, 281, those are not belonging to the rejection area.

Discussion

According to the results of the Independent – Samples T Test, the null hypothesis was accepted. Independent – Samples T Test was used to consider ***Null Hypothesis H $_0$:*** *Female self – employees' average profit volume is equal to the male self – employees' average profit volume in the agricultural sector of Georgia*. In case of the male self – employees, the reason of the reducing profit volume, is fuel consumption expenditures, because fertilizers & chemicals consumption leads to an increase in the volume of harvested crop and, accordingly, increasing of the income volume. It can be said, that fuel consumption expenditure is the factor, which causes the equality of the female and male self – employees' average profit volume. The importance of the automatization and robotization, lies in the fact that it can eliminate the consumption of fossil fuels and replace them with cheaper alternative energy sources, which will have a real positive impact on the increasing of the average profit volume in case of the male self – employees, in the conditions of exploitation of the agricultural purpose property. In conditions, that if female self –

employees will be able to exploit the automatic agricultural purpose property, their average profit volume will be increased accordingly to the male self – employees and the gender inequality, which manifests in the limited availability for female self – employees to the agricultural purpose property, will be overcoming in the agricultural sector of Georgia.

Conclusion

The purpose of the research, is to study the Importance of the High – Tech Land Cultivation for Increasing the Profitability of the Self – Employed Farmers in Georgia, which is depend on the automatization and robotization, for which the research was conducted in Shida Kartli region according to a specially prepared questionnaire. As a result of the research, the factors affecting the profit volume were revealed and hypotheses were discussed, as a result of which it was revealed that fuel consumption expenditure determine the equality of the female and male self – employees' profit volume. Otherwise, male self – employees' average profit volume will be higher, than female self – employees' average profit volume. According to the data analysis, automatization and robotization will have a significant real positive impact on the increasing of the average profit volume in case of the male self – employees, in the conditions of exploitation of the agricultural purpose property.

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