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Interrelationship between the Use of New Agricultural Inputs and Socio-economic Factors

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Abstract

This paper deals with interrelationship between the use of new agricultural technology and socio-economic factors in Dhankuta municipality, eastern hills of Nepal. This area offers a lot of resources; here the researcher examines the role of socio-economic factors to diffuse new technology in this area too. Relevant data were obtained from both primary and secondary sources. Primary data were collected from the interview, key informant survey and field observation. For this, approximately 33 percent sample households (166hhs) were selected out of total 506 households from ward no. 3 of the municipality. Similarly, secondary data were gathered from various books, journals and official records. To identify the mutual relationship between these components, mathematical tools chi-square test and Karl Pearson's correlation were performed. The study reveals that there is a close relationship between the use of new agricultural inputs and socio-economic factors of the study area. The relationship seems highly significant between age, training, farm size, service of agriculture service center and membership of farmers in organization and adoption of new agricultural technologies however; the inter-connection with sex, ethnicity and education of the farmers reveals less significant among these factors. Nowadays, more than 78 percent (130hhs) farmers are using such inputs in the study area and the remarkable change in crop production can easily be seen due to the impact such innovations.

Keywords: Khasarya, Agricultural inputs, plant protection measures, improved seeds and seed treatment.

Introduction

Agriculture is the major important source of income and livelihood in the eastern hills of Nepal. Most of the farmers are still dependent on the traditional farming system however the majority of the people are engaged in various agricultural activities (Oli, 2002). The new inputs indicate the use of improved techniques and better technologies in the agricultural sector to achieve better output. In Nepalese context, various new techniques have been using to increase quality and quantity of crops both. Chemical fertilizers, improved seeds, pesticides and insecticides and seed germination test/seed treatment (SGT/ST) have been widely adopted as new technologies for a long time in the eastern hills but the acceptance of such technologies depends on several spatial and socio-economic factors (Wagle, 2019). In

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addition, farmers' perceptions, infrastructure and the economic incentives of the agriculture sector are also equally important to decide on alternative production techniques. It can be argued that those farmers who adopt farm inputs have certainly changed their products to get good prices from the market. But it requires too much time to watch-and-see from their neighbors, to advice continuously, and to increase their understanding about the new technologies (Wagle, 2020). It is mainly due to most of the resource constraints farmers largely unable to use their land, labor and capital in better way in many developing countries (Berner, et al 1984).

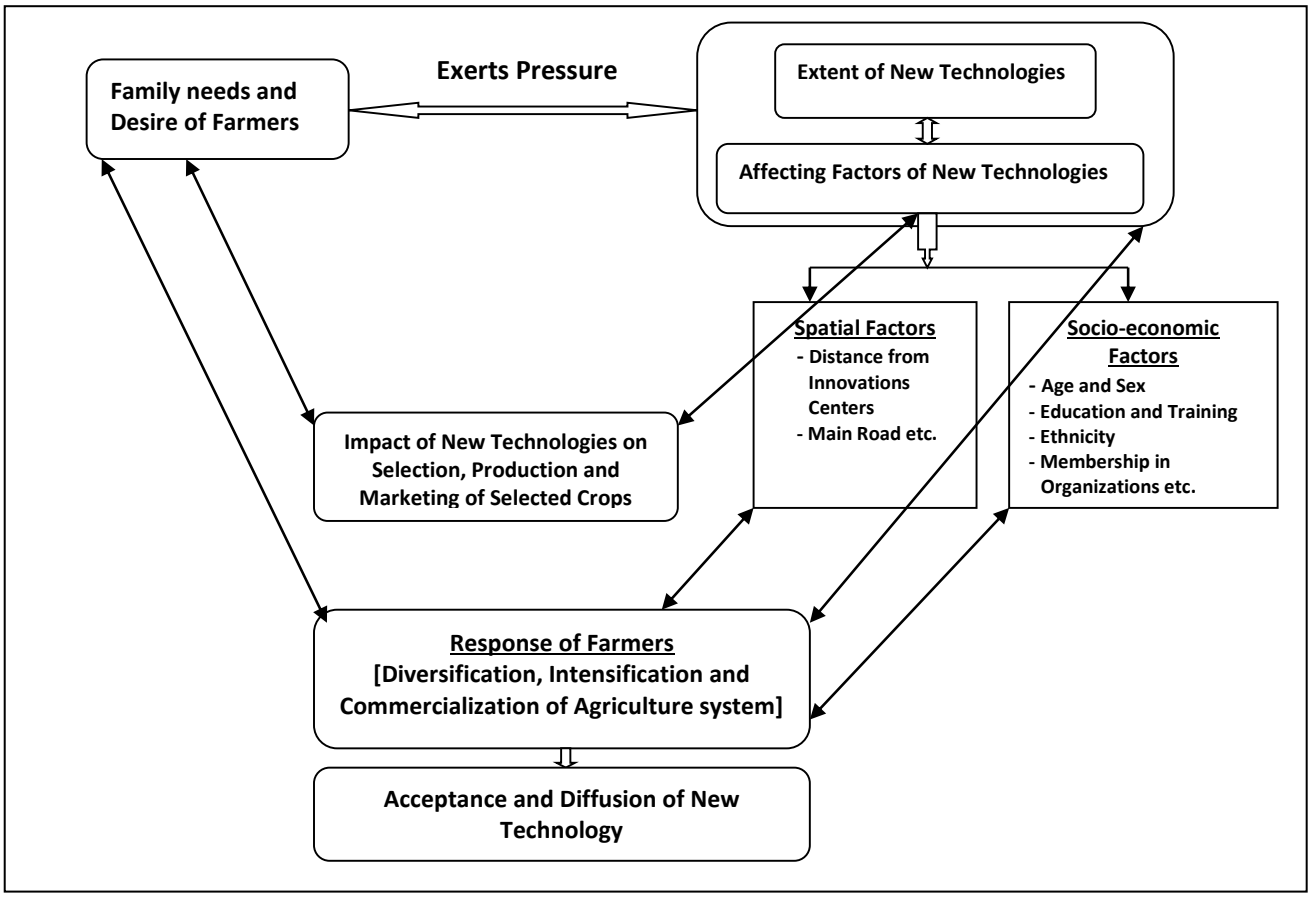
The acceptance of new tools and techniques depends on family needs, personal desires and perception of the farmers (Pathak, 2010).Virgo & Subba (1994), Khatiwada (2014) and Wagle (2019/20) had also studied on similar issues in eastern hills and concluded that there are some changes occurred in the agriculture sector such as market expansion of agricultural production, farmers' attraction towards new inputs and displacement of cereal-based subsistence farming by high valued commercial crops etc around the Koshi Highway. Moreover, they have also pointed out that the establishment of the then Pakharibas Agriculture Research Centre (PAC), increasing access to roads, farmers' self-efforts and market integration, and several governmental and non-governmental organizations' supports are drivers to this change. Some studies concerned with the use and acceptance of such technologies have been done in the case of the eastern hills however; there is a lack of analytical studies on the use of new inputs and their interrelationship with spatial and socio-economic environment. In this context, this paper attempts to address the issue concentrating only with the socio-economic environment in detail by raising research questions: what is the role of socio-economic factors to diffuse new technologies and which socio-elements play significant role in the dissemination of such technologies.

Method and Materials

Mainly, this study is based on field data, collected in 2020 using household questionnaire survey, key informant and observation methods. The detailed questionnaire survey was conducted on 166 households which cover about 33 percent of the universe (506 households). The semi-structured questionnaire was used to collect socio-economic data. Moreover, secondary data were also used to complete the research works which were gathered through various books, journals and official records. In addition, collected data were tabulated as required. Chi-square test and Karl Pearson's correlation coefficient and Simple statistical tool percentage are used to analyze the relevant data. Based on the analysis of collected data, a descriptive paper is prepared. Both quantitative and qualitative techniques have been used in order to achieve the goal. Moreover, chemical fertilizers, improved seeds, plant protection measures (PPM), Seed treatment and Seed Germination test (ST& SGT) are taken as basic parameters of new agricultural inputs. Similarly, various socio-economic factors play an important role in the development and expansion of agricultural activities. This study attempts to evaluate the existing relationship between the 8 major socio-economic factors (such as the age, sex, cast, education, and training of the farmers; farm size, membership in organizations and service of agriculture centers) and the use of new agricultural inputs among the various socio-economic factors on descriptive and mathematical basis. Besides, those households that adopted all inputs included in the study are considered ‘adopters’ and the later groups fall in the category of non-adopters in the study. The entire study has followed the process illustrated in the schematic diagram 2.2 based on *state - impact* concept (Figure 2.1).

Figure 2.1

A Schematic Diagram for the Overall Study



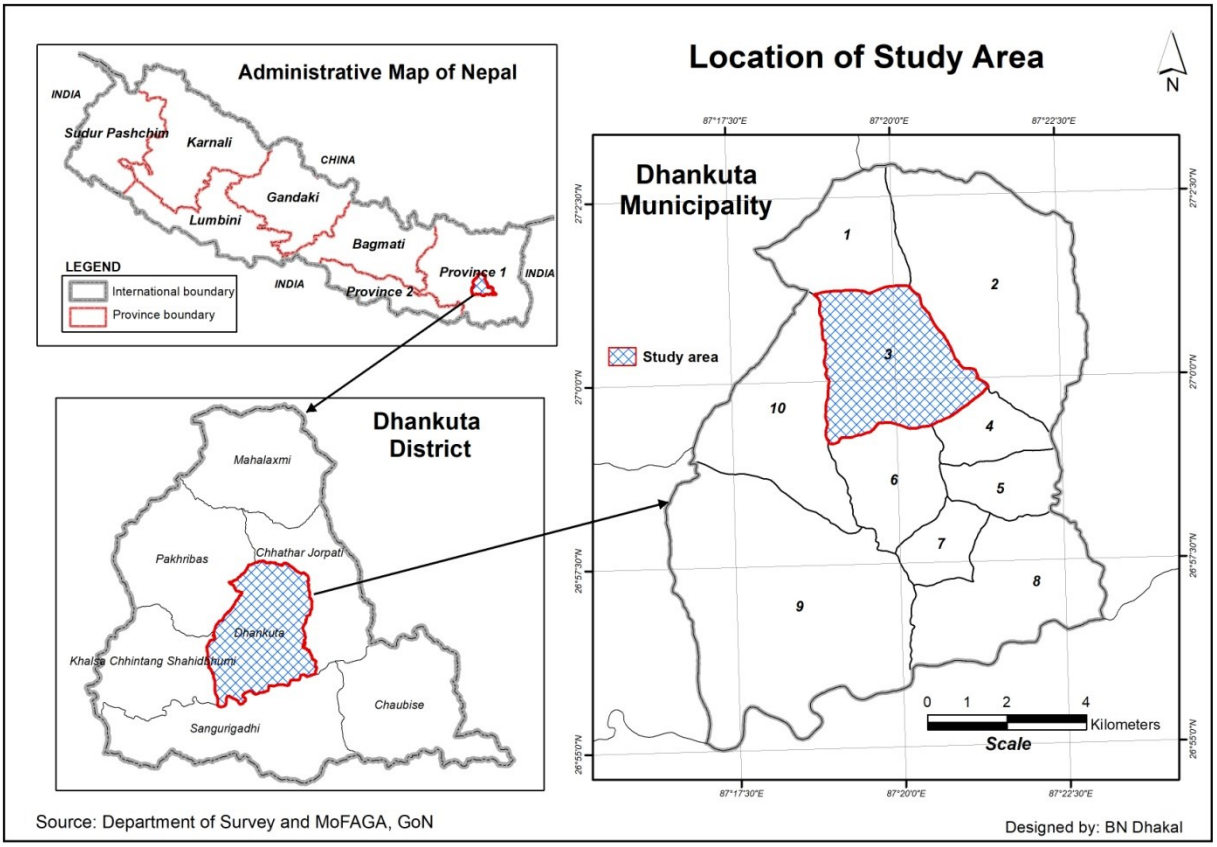
Adopted from Pradhan & Pradhan, (2006, p 28)

Study Area

Dhankuta Municipality located in the mid-hilly region of eastern Nepal has selected as the study area. It is situated almost in the centre of Dhankuta district. The northern and eastern borders of this municipality are connected with Chhathar Jorpati rural Municipality. Similarly Pakharibas Municipality is situated on the western border of the municipality and the southern boundary is linked with Sangurigadhi Rural Municipality. This municipality lies on the southern slopes of the Mahabharata mountain range which covers an area of 110.80 square kilometers (Dhankuta Municipality, 2018).

Figure: 2.2

Location of the Study Area



Geographically it is spread from $87^0$16' 16/585" to 87^0 22' 58/528" east longitude and 26^0 55' 4/88" to 27^0 2' 56/461" north latitude. The area falls under the lesser Himalayas and the altitude ranges from 250 to 2144 masl. Considering the geographical structure of this municipality, it can be divided into the sloppy hilly area and the flat basin area. This area is known as the temperate monsoon climate zone where the maximum temperature (28.6^0 c) is found in July and August. April, May, June July, August, and September are known as summer months. Similarly, October, November, December, January, February and March are identified as winter months. The lowest temperature falls in December (5.8^0 c) and the average temperature of the winter season is around 12^0 Celsius. Most of the rainfall occurs in the summer months and the average rainfall during these months is 150 cm (Dhankuta Municipality. 2074/75, as cited in Wagle, 2019)). Administratively, this municipality is divided into 10 wards. The total population of the municipality is 34156 of which 18026 are females and 16130 are males (Dhankuta Municipality, 2018).

The main focal point of the study is ward no. 3 and it is almost in the centre of the municipality. The total area of the ward is 7.2 square kilometers and most of the land is made of sloppy terrain. According to the census of 2011, the population of this ward is 2048. Out of the total population 1084 are females and 964 are males. This area is known as the settlement of Kshetri, Brahman, Rai, Tamang and Dalit. Agriculture is main occupation of the people and cereal crops, vegetables and fruits are major varieties of the farming (Dhankuta Municipality, 2018).

Results and Discussion

The Age of the Farmers

Agriculture needs more energetic and laborious man power because of its laborious nature. It seems that, the young people are more laborious than the people of the old age in general situation. So, it is expected that there is close relationship between the age of the farmers and the adoption rate of the innovation (Wagle, 2019). To identify the relationship between these two components both adopter and non-adopter farmers are divided into two groups as below the mean ($< \bar{x}$) age group and above the mean ($> \bar{x}$) age group on the basis of their age. Then the below the mean ($< \bar{x}$) age group is considered as the young farmers and the above the mean ($> \bar{x}$) age group is known as the mature/ older farmers. The mean age of the respondent farmers is identified 54 years by using the formula of calculating mean. The relationship is illustrated in the table based on the average age of the respondent farmers (Table, 1)

Table 1

Age of the Farmers and the Use of New Agricultural Inputs

Adoption of New Inputs	Age of the Farmers				Total
	Below Mean		Above Mean		
	Frequency	Percent	Frequency	Percent	
Adopters	85	65.38	45	34.62	130
Non-adopters	30	83.33	6	16.67	36
Total	115	69.27	51	30.73	166

Table 1 reveals that more than 78 percent (130hhs) farmers are as the adopters of the new agricultural inputs. Almost, 65 percent (85hhs) farmers includes from the young group and nearly 35 percent (45hhs) from the mature/old group among them. Similarly, around 22 percent (36hhs) farmers are non-adopters. The participation seems almost 83 percent (30hhs) from the young group and nearly 17 percent (6hhs) from the mature/ old group among them. Moreover, almost, 70 percent (115hhs) farmers of the study area fall under the category of the young group and only around 30 percent (51hhs) framers remain under the category of the non-adopter among the total farmers.

The chi-square test is used to examine the relationship of age group and acceptance of the inputs. The chi-square value 5.54 is greater than the theoretically derived value 3.84 for a degree of freedom at 5 percent significant level. Based on the chi-square test value, the conclusion can be derived that there is a significant relationship between these components. If opportunities and facilities are made possible, the young farmers may involve in the agricultural work through the adoption of new inputs. Similar studies by Pyakuryel (1978) and Wagle (2019) also support this result. Both studies have shown that there a positive relationship between these two components. However, Aryal (1983) and Pathak (2010) have found different outcomes on the studies of similar topics. Their studies show that there is no relationship between the use of new agricultural inputs and age of the farmers. The conclusions of the studies indicate that if other things remain equal, the farmers of the all age groups may adopt the new agricultural techniques.

Gender/ Sex of the Farmers

Gender/sex is a crucial social factor that determines various activities of the farmers (Aryal, (1983), Pathak, 2010,& Wagle, 2019). This study also examines the relationship between the sex of the farmers and the adoption of the new agricultural inputs. The use of such inputs in the study area seems to be satisfactory including equal participation of the both genders/sexes (Table 2).

Table 2

Sex of the Farmers and the Use of New Agricultural Inputs

	Sex of the Farmers				
	Male	Percent	Female	Percent	Total
Adopters	89	68.46	41	31.54	130
Non-adopters	20	55.55	16	44.45	36
Total	109	65.66	57	34.,34	166

Table 2 reveals that 89 households (more than 68 percent) are headed by males and only 41 households (almost 32 percent) by females among the total 130 adopter farmers. Similarly, 20 households (nearly 56 percent) are headed by males and only 16 households (more than 44 percent) by females among the total non- adopters. The figures indicate that most of the farm households are handled by the males. However, the participation of all members seems equal in their agricultural works without discrimination of sex.

The computed chi-square value 0.079 is seen as lower than the table value 3.84 for one degree of freedom at 5 percent significant level. The result obtained from the calculation shows that there is no significant relationship between the two components. The result also suggests that if opportunities and services are made available, both sexes are capable to adopt these innovations in equal rates. This result is also supported by the similar studies of Pathak (2010) and Wagle (2019). They also found the same result from their studies in the case of Dhading district and the eastern hills of Nepal.

Ethnicity of the Farmers

The role of ethnicity seems remarkable to determine the variety of crops and the adoption of innovations (Wagle, 2019). Pyakuryel, (1978) argues that several similar studies within and beyond the country have proved that cast/ethnicity is also remarkable influencing factor to make agricultural technology acceptable. The study area is also identified as a residence of various ethnic groups. Considering this fact, this study attempts to analyze the mutual relationship between these two components (Table 3).

Table 3

Ethnicity of the Farmers and the Use of New Agricultural Inputs

Castes	Adopters	Percent	Non-adopters	Percent	Total
Chhetry/ Brahmin	74	57	19	52.78	65
Rai	18	13.80	2	5.56	20
Magar	11	8.50	3	8.33	14
Newar	7	5.40	4	11.11	11
Tamang	6	4.60	5	13.89	11

Dalit	6	4.60	3	8.33	9
Gurung	6	4.60	0	0	6
Limbu	2	1.50	0	0	2
Total	130	100	36	100	166

Chi-square test is performed to identify the reality of the study area. The computed value 0.31 is lower than the table value 3.84 for one degree of freedom at 5 percent significant level. It shows that there is no association of ethnicity with the use of new agricultural inputs in the study area. The result also suggests that if opportunities and facilities are made available farmers of all cast are capable to adopt the innovations at the same rate. The studies made by Aryal (1983), Sharma (1981) and Wagle (2019) also support this outcome however, the study of Pathak (2010) does not agree with this result. He has found a positive relationship between these two components in a similar study of the Dhading district.

Education of the Farmers

Education is taken as a light of life. It plays a decisive role in every sector of human life and without education nothing is possible. It is said that better education gives better output. Similarly, most of the studies done in the agricultural sector reveal that the capacity of literate /educated farmers is higher than that of illiterate farmers (Wagle, 2019). It is believed that literate/ educated farmers are capable to adopt new technology more quickly than illiterate farmers (Pathak, 2019). However, the result of this study is a little different than the result of previous researches (Table 4).

Table 4

Education of the Farmers and the Use of New Technology

Adoption	Education				Total
	Literate	Percent	Illiterate	Percent	
Adopters	124	95.38	6	4.61	130
Non-adopters	32	88.89	4	11.11	36
Total	156	93.98	10	6.02	166

Table 4 reveals that more than 95 percent (124hhs) farmers are literate among the total 130 adopter farmers. Similarly, around 89 percent (32hhs) farmers are literate from the total 36 non-adopters. The literacy rate is comparatively higher among the adopter farmers in comparison with the non-adopters.

Moreover, the computed value of chi-square test 3.05 is seen less than the table value 3.84 for one degree of freedom at 5 percent significant level. The result shows that there is less significant relationship between education of the farmers and the adoption of new agricultural inputs in the study area. It means the role of education seems effective to determine adoption rate of innovations in the study area but not decisive. The studies of Pyakuryel (1978) and Sharma (1981) have found a positive relationship between the educational status and the adoption of new inputs in the similar study. However, Pathak (2010) and Wagle (2019) have found no significant relationship between these two components in the case of Dhading District and the eastern hills of Nepal.

Training of the Farmers

Khatiwada (2014) concludes that training plays remarkable role to achieve sound result from agricultural activities. It provides new skills, new knowledge and ideas to adopt new technology in the agricultural works to make it sound and profitable. Wagle (2012) argues that generally, trained farmers have gained more success to achieve better output in comparison with the non-trained farmers (Wagle, 2019). By adopting these ideas, the data collected in the study area has been displayed the table (Table 5).

Table 5

Training of the Farmers and the Use of New Agricultural Inputs

Adoption	Status of Training				Total
	Involving	Percent	Not involving	Percent	
Adopters	94	72.31	36	27.69	130
Non-adopters	19	52.78	17	47.22	36
Total	113	68.07	53	31.93	166

Table 5 shows that more than 72 percent (94hhs) farmers among the total 130 adopters and almost 53 percent (19hhs) farmers from the total 36 non-adopters have involved in training programs at least one time organized by various agencies. In this way, more than 68 percent (113hhs) farmers have involved in the training (one or more times) related to this sector out of the total farmers. However, almost 32 percent (53hhs) farmers still deprive from the trainings. This situation is more satisfactory as compared to other areas of the eastern hills.

The chi-square test value also shows that there is significant relationship between training and adoption of new agricultural inputs. The computed value 3.90 is relatively higher than the table value 3.84. This test has done in one degree of freedom at 5 percent significance level. The study of Pathak (2010) and Wagle (2019) also support the result of this study. Both studies found much significant relationship between the farmers training and adoption in the case study of Dhading district and the eastern hills of Nepal.

Membership of the Farmers in Organization

Khatiwada (2014), Pathak (2010) and Wagle (2019) have concluded that usually, a farmer who involves in an organization has got more chances to identify new ideas and technologies as compared with other farmers. Therefore, they are more innovative, exposure of new ideas and technologies and pioneer than the farmers who are not joined in such organizations. The result of this study is also consistent with this conclusion (Table 6).

Table 6 indicates that more than 90 percent (150hhs) farmers have involved at least in one organization of either national or local level. Almost 77 percent (116hhs) are adopters and nearly 23 percent (34hhs) are non-adopters among them. In addition, nearly 90 percent (116hhs) of adopters and more than 94 percent (34hhs) of non-adopters have involved in such organizations.

Table 6

Membership in Organization and the Use of New Agricultural Inputs

Adoption	Status of Membership				Total
	Yes	Percent	No	Percent	
Adopters	116	89.23	14	10.77	130
Non-adopters	34	94.44	2	5.56	36
Total	150	90.36	16	9.64	166

The computed chi-square Value 10.07 is much higher than the table value 3.84 for one degree of freedom at 5 percent significance level. Therefore, there is significant relationship between these two components. The studies of Malla (1986), Mathema (1986), Pathak (2010) and Wagle (2019) are seen as similar to this study. The studies of Malla, Mathema and Wagle have revealed a positive relationship but the result of Pathak has showed less significant relationship between these components.

Service of the Agricultural Service Centers

The acceptance and promotion of new agricultural technology depends on service of the agricultural service centers. Information related to this process may be diffused from these centers through the help of various sources like printed books, booklets, pamphlets, electronic media and direct contact etc (Wagle, 2019). This study also reveals that the role of agricultural service centers is important in the diffusion of these inputs in the study area (Table 7).

. **Table 7**

Service of Agricultural Service Centers and the Use of New Agricultural Inputs

Adoption	Status of Service				Total
	Yes	Percent	No	Percent	
Adopters	104	80	26	20	130
Non-adopters	26	72.22	10	27.78	36
Total	130	78.31	36	21.59	166

Table 7 shows the existing relationship between the framers and the agricultural service centers. The data indicate that exactly 80 percent adopter (104hhs) and almost 72 percent (26hhs) non-adopter farmers are under the contact of the agricultural service centers and agricultural technicians either frequently or partially. Similarly, more than 78 percent (130hhs) farmers are seen under the contact of these sources either frequently or partially out of the total numbers.

The computed chi-square value 3.94 has revealed the significant relationship between these two elements because the computed chi-square value 3.94 is higher than the table value 3.84 for one degree of freedom at 5 percent confidence level. The findings of other similar studies have also shown the effective role of these centers. The studies of Pyakuryel (1978), Malla (1986), Mathema (1986), Pathak (2010) and Wagle (2019) also

support this result. They have found a positive relationship between these two components in the context of Nepal.

Farm size

The farm size of the study area has been classified into three major categories: first, second, and third based on the land available with the farmers. The farmers with 0.50 - 1.00 hectare of land are placed in the first category. Similarly, the farmers with 1.01- 1.50 hectares of land are included in the second category. Likewise, the farmers having more than 1.51 hectares of land are grouped under the third category. Moreover, the farmers who have less than 0.50 hectares of land are not included in the study. This study assumes that they do not have sufficient capacity to use new inputs because the majority of such farmers work as labors to meet their daily needs (Table 8).

Table 8

Farm size of the Farmers and the Use of New Agricultural Inputs

Size of Farm (in hec)	Adopters	Percent	Non-Adopters	Percent	Total	Percent
<1.00	90	69.23	26	72.22	116	69.88
1.01 – 1.50	23	17.69	4	11.11	27	16.27
1.51 +	17	13.08	6	16.67	23	13.85
Total	130	100	36	100	166	100

Karl Pearson's correlation co-efficient has computed to find out relationship between farm size and the use of new agricultural inputs. Midpoint value has been taken from every group of landholders to identify *r* value or relationship between these two components. The computed the value of r = 0.74 has revealed a positive relationship between the farm size and the use of new inputs. The result of this study is similar with other studies to similar cases. The study of Aryal (1983), Mathema (1986), Pathak (2010) and Wagle (2019) found a positive relationship between these two components in context of Nepal.

Conclusion

Farmers' communities in the study region as in Nepal vary largely due to location. The settlements of Khas /Arya (Brahmin/ Chhetry) are usually confined to low land or basins where there is productive agricultural land or Khet land for rice and wheat as principal staple crops, whereas ethnic groups usually live in the highland where staple crops such as maize, millet, potato, etc are grown. Besides, farmers of all ethnic groups are seen as quick users around the main road in comparison with the farmers of far distance from the highway links.

The analysis of various socio-economic data in the study area shows the close relationship between the use of new agricultural inputs and the socio-economic factors but the intensity of the relationship seems to depend on the nature of these factors. Chi-square test indicates the significant relationship between the age of the farmers, training, memberships in organizations and service of agricultural service centers and the adoption of new agricultural inputs respectively. In this way, the computed Karl Pearson's correlation value also shows the close relationship between the farm size of the farmers and the use of

such technologies in their agricultural works. Similarly, this study also reveals the weak relationship between the sex, cast/ethnicity and education of the farmers and the adoption of innovations. This result suggests that if we provide opportunities, technical and economic supports and inspiration to them, farmers of both sexes and all casts are capable to adopt new technologies in their agricultural works either literate or not. In conclusion, the success or failure of new agricultural inputs also depends on the relationship between these inputs and the socio-economic factors. Therefore, for the success of commercial farming, it is necessary to access the mutual relationship between these two components from time to time.

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