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THE INFLUENCE OF FARMERS' DEMOGRAPHIC CHARACTERISTICS ON THE ADOPTION OF COMMERCIAL RABBIT PRODUCTION IN HAI DISTRICT

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ABSTRACT
This paper determined the relationship between demographic characteristics of respondents and the adoption of commercial rabbit production in Hai District. The word, "Demo"- comes from the Greek root word demos meaning "people" and "-graphic" meaning "description." Thus, demographic characteristics are the description of people's characteristics. In the study, the demographic characteristics that were considered include - age of the respondents, education level, sex, marital status, household size, average monthly income in (TSH). Commercial rabbit production refers to raising rabbits for income-generating purposes. Thus, the rabbit production in this paper is for business purposes. The commercial rabbit production has several benefits because all the products and by-products have commercial value. For instance, rabbit skins are used to make blankets and many items of cherished dress for children and adults, such as shirts, leggings, socks, hoods, purses, and modern cases. Rabbit urine and manure are used to manufacture organic booster and pesticide. Commercial rabbit production has been in Hai District since 2018 as introduced by the Saore Company Limited. Despite its several benefits and determinations made by Saore Company Limited to promote commercial rabbit production in the district, only 0.001% of the population is engaged in commercial rabbit production. Several studies have associated the adoption of innovations with demographic characteristics. Captivating commercialization of rabbit production as an innovation, this study wanted to identify demographic characteristics of the respondents that influence the adoption. The study did a research survey design to collect data from 170 (85 commercial and 85 non-commercial rabbit producers) respondents using a questionnaire. Data triangulation was done through key informant interviews. Both descriptive and inferential statistics were used to scrutinize the data whereby binary logistic regression model was fitted. The study found that, sex, marital status, household size, average monthly income in (TSH) positively influenced the adoption of commercial rabbit production in the study area.

Keywords**: Adoption, Commercial rabbit, Demographic Characteristics**

I. INTRODUCTION

Poverty is among the three enemies in most developing countries that hinders development of rural communities. In most countries worldwide, different interventions have continued to be made to combat poverty and hunger. One of the interventions reported as potential in alleviating poverty alleviation and enhancing food security in poor farm families is rabbit production (Appiah, *et al*. 2011; Lukefahr, 2008; Chipo *et al*. 2019; Troccino, *et al*. 2019; Adanguidi, 2020; Mutsami and Karl, 2020). A study by Lukefahr (2008) found out that the potentiality of rabbit production in achieving these goals was evident in China, Mexico, Egypt, Ghana, and Cameroon through commercial rabbit. In this study, commercial rabbit is the type of rabbit kept for income generating purposes only. There has been low adoption of rabbit and rabbit technologies introduced to farmers (Onuekwus and Okezie 2007). A farmer is considered a rational decision maker who usually endeavours in lieu of improved livelihood and finds the means of adopting new technologies. In this paper, the adoption of commercial rabbit is the process of starting rabbit production purely for business.

Rabbit is kept worldwide for meat production amounting to 1.8 million metric tons a year (FAOSTAT, 2019). The percentage global rabbit meat production of 1.8million metric tons a year in Asia is 48.8%, Europe is 28.4% America is 18.1% and Africa is 4.7% (FAOSTAT, 2019). China is a leading rabbit meet producing country globally. It produces 457 765 tons/year, mostly for export. The next leading rabbit meat producing country is North Korea producing 166 879 tons/year, the third is Egypt producing (44 893 tons/year), Italy is fourth producing (26 647 tons/year) followed by Russia in the fifth place producing 17 948 tons/year. The sixth is Ukraine producing 11 600 tons/year and the seventh is Algeria producing 8569 tons/year (FAOSTAT, 2019). The leading countries worldwide in rabbit meat consumption is Italy and France; where by China import rabbit meat from different African countries and process the same to add value for export to Italy and France. On top of that, Italy supports rabbit production in Egypt and Algeria provide market for rabbit meat (Troccino *et al*. 2019).

In Africa, the leading rabbit meat producing countries are Egypt, Algeria, Morocco, and Tunisia whereby Egypt and Algeria funds small-scale farmers in rural community to support rabbit production. Moreover, these are among the main global rabbit meat producing countries (Troccino *et al*. 2019). The other main rabbit meat producing countries are in the sub-Saharan Africa, and these are Nigeria and Ghana. Other most rabbit meat producing countries in Africa are the Democratic Republic of Congo, Cameroon, and Coted'voire (FAOSTAT, 2019). Commercial rabbit production in these countries is family owned with part of output for the market.

In Tanzania, rabbit production system is dominated by traditional production in hatches and rarely in cages, this system is similar to the one practiced in Ghana whereby a farm family keeps only three to six rabbits, feeding mainly on local products such as kitchen leftovers, potato leaves, sow thistle, and blackjack (Troccino *et al*. 2019).

Commercial rabbit production offers an additional source of income, have short break-even periods since they are prolific, offers high price per kilogram live weight compared to other types of meat available on the market today, and have rapid growth rate and genetic diversity. Also, rabbits have the best white meat, which has high per cent of digestible protein, it contains the least amount of fat, it is cholesterol free and therefore it is friendly to heart patients, it has less sodium content, it has more phosphorus and calcium content than other types of meat. Moreover, rabbit meat increases potency in men and reduces infertility in women, it contains high amount of zinc, iron and omega three; thus, it increases brain functioning and memory (Rajendran *et al*. n.d). Rabbit skins are used for making blankets and numerous stuffs of valuable clothing for children and adults such as shirts, leggings, socks; rabbit fur leather boots, duvet, hoods, purses, and modern cases. Rabbit brain is processed to form Rabbit Brain Cephalin used in coagulation reaction in the laboratory. Rabbit urine and manure are used to manufacture organic booster and pesticides for example, **MKOMBOZI** fertilizer, which is manufactured by Saore Company Limited in Tanzania (Key informant interview, Production Manager Saore Company Limited, May 17 2023). Rabbit feed on both forages and by-products make rabbit suitable for both rural and urban production (Rajendran *et al*. n.d).

A. Rabbit production in Hai district

Rabbit production is carried out throughout all 62 villages of the district, among all rabbit producers only 240 farmers are convoluted in the production of commercial rabbit (Key informant interview, the Production Manager, Saore Company limited, May 17, 2023). Commercial rabbit production has been in the district since 2018 as initiated by Saore Company Limited. The Company conducts contract farming of commercial rabbit production (Key informant interview, Production Manager Saore Company Limited, May 17 2023).

The market conditions of the company include, raising rabbit organically free of antibiotics and chemicals. This is achieved by supplying rabbit breeds to contracted farmers from the company farms where rabbits are reared organically with the production and breeding history of rabbit breed supplied to farmers. In addition, the company offers contracts, which compel farmers into following organic production practices (Key informant interview, Production Manager Saore Company Limited, May 17 2023).
Farmers that meet production requirements sell their products at higher prices than those who do not; and normally, those products that do not meet the standards are rejected at the farmers cost. (Key informant interview, Production Manager Saore Company Limited, May 17 2023)

In spite of the potentials associated with commercial rabbit production and the efforts made by Saore Company Limited to support commercial rabbit farmers in the district, only 0.001 per cent of the population is involved in commercial rabbit production. Different studies (Onuekwus and Okezie, 2007; Appiah *et al*., 2011; Abayomi *et al*., 2019; Chipo *et al*., 2019; Liu *et al*., 2019; Trocino *et al*., 2019; Grimm and Luck, 2020; Kusuma *et al*., 2020; Eze *et al*., 2021; Nagar *et al*., 2021) have associated the adoption with the demographic characteristics. This paper therefore, establishes the influence of sex, marital status, household size, and the average monthly income on the adoption of commercial rabbit production in Hai District.

The findings in this paper will assist development planners to formulate policy that will take into account sex, marital, household size and average monthly income in improving the adoption and productivity of commercial rabbit production in Hai District. The findings align with the National Development Vision 2025; whose goal is to accomplish high quality livelihood. They also align with the National Strategy for Growth and Reduction of Poverty (NSGRP II). The strategy focuses on poverty alleviation among rural community through improving the adoption and productivity, which in this study is the adoption and productivity of commercial rabbit (Tanzania, 2010), and thereby, achieving the Millennium Development Goal number one (MDG I) which aims at reducing poverty and hunger.

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B. Research hypotheses

1.Age

H_0: Age does not influence the adoption of commercial rabbit production.
H_1: Age influences the adoption of commercial rabbit production.

2. Education level

H_0: Education level does not influence the adoption of commercial rabbit production.
H_1: Education level influences the adoption of commercial rabbit production.

3. Sex

H_0: Sex does not influence the adoption of commercial rabbit production.
H_1: Sex influences the adoption of commercial rabbit production.

4. Marital status

H_0: Marital status does not influence the adoption of commercial rabbit production.
H_1: Marital status influences the adoption of commercial rabbit production.

5. Household size

H_0: Household size does not influence the adoption of commercial rabbit production.
H_1: Household size influences the adoption of commercial rabbit production.

6. Income

H_0: Income does not influence the adoption of commercial rabbit production.
H_1: Income influences the adoption of commercial rabbit production.

II. LITERATURE REVIEW

A. Empirical literature review

A study by Appiah *et al*. (2011) in Ghana found that the adoption of rabbit technologies is influenced by age, marital status, type of farming, and the main purpose of entering rabbit business. Aged people were more likely to adopt rabbit technologies than were the younger ones. Married people were more likely to adopt the

technology than were the singles and widows. The type of farming, commercial farming influenced the adoption than did the traditional farming.

Kusuma *et al*. (2020) in a study on information and communication technology adoption in small-and medium-sized enterprises focusing on demographic characteristics in Asia, found that age, marital status and years of experience had positive influence on the adoption of new technology. Younger managers/owners were likely to adopt new technology than were older managers/owners. The later were more likely to stick to organizational status quo and less likely to adopt new technology, and more likely to avoid risky decision.

A study by Eze *et al*. (2021) on demographic determinants of mobile marketing technology adoption by small and medium enterprises (SMEs) in Ekiti State, Nigeria reported that age, experience, and gender, positively influenced the adoption of mobile marketing.

A study by Mwangangi (2014) on *factors influecing the adoption of commercial rabbit production among farmers in* Nakuru District in Kenya found that 44 per cent of rabbit farmers were above 50 years of age.

A study by Abayomi *et al*. (2019) on the effects of demographic factors on customers' adoption of mobile banking services in Nigeria found that age, gender, income level, and occupational level, influenced the adoption of mobile banking. This study determined the characteristic of commercial rabbit producers and non-rabbit producers that influence the adoption of commercial rabbit production in the study area.

B. Theoretical framework

This study was grounded on the Unified Theory of Acceptance and Use of Technology (UTAUT). For individuals to adopt the given innovation they have to construct unique perception, which influences their adoption decisions (Straub, 2009).

The theory categorizes three direct determinants of an individual behavioural intention to use a technology - performance expectancy, effort expectancy, and social influence; two direct determinants of technology use - behavioural intention and facilitating conditions; and four contingencies - gender, experience, age, and voluntariness that would change the effect on intension and/or behaviour (Venkatesh and Thong, 2016).

Performance expectance is the degree to which someone believes that using a certain technology helps to attain benefits; and this is believed to be a positive determinant of behavioural intention for young men (Tamilman *et al*. 2021). Effort expectance is based on the idea that there is a relation between the effort used to perform a given technology and the benefits gained; and this is believed to be strong in old women in early stage of experience. Social influence is the way an individual accepts the technology to meet the demand of a social group; and this is believed be contingent on gender, age, experience and voluntariness. Favourable condition is the degree to which someone believes that an organization and technical infrastructure exists to support the use of the technology (Venkatesh and Thong, 2016). From the theory, the study used the following demographic characteristics: age, education level, sex, marital status, household size, and income to determine their influence on the adoption of commercial rabbit production.

C. Conceptual framework

The conceptual framework is a diagrammatic representation of the theory showing the relationship between the variables identified for the study. It shows the relationship between the independent and dependent variables. For this particular study, the adoption of commercial rabbit production by farmers is the dependent variable while age, education level, sex, marital status, household size, and income are independent variables.

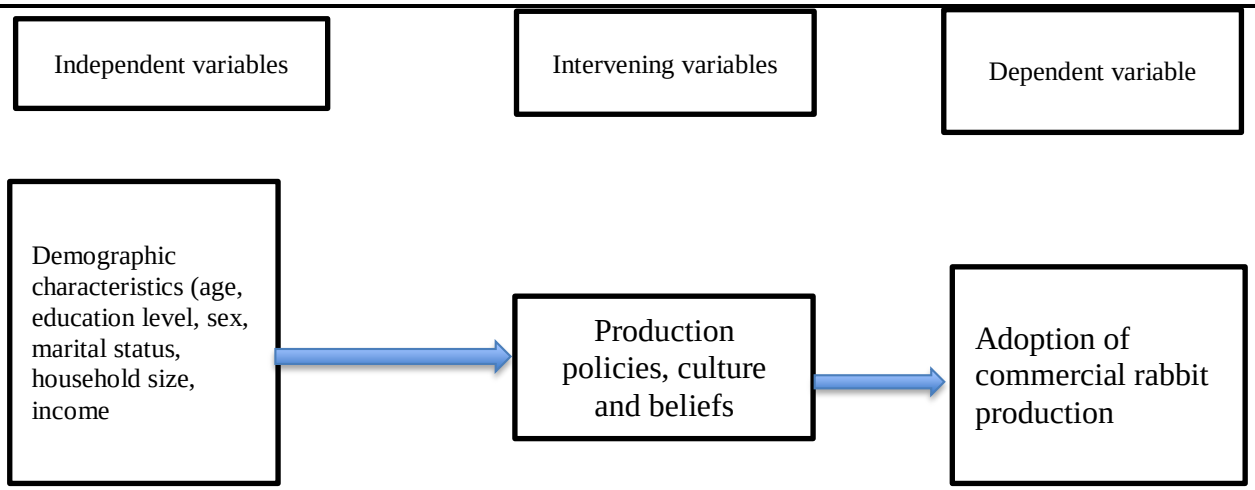

Figure 1: Conceptual framework

III. METHODOLOGY

A. Description of the study area

The study was conducted in Hai District in Kilimanjaro Region involving 240 commercial rabbit producers. The district has 14 wards with 67 villages. Livestock production is the major source of their income and livelihood. Livestock kept in the district includes cattle, pigs, goats, sheep, poultry, and rabbits. At present, farmers have a market for rabbit and rabbit products from Saore Company Limited with its headquarters in the district and hence the reason for selecting Hai District.

B. Research design

This study used a cross-sectional research design. The design allowed the collection of data at a single point in time, making the exercise quicker and cheaper in terms of resources (Creswell, 2017). Additionally, the design is useful for descriptive purposes and determination of relationship between different variables.

C. Sampling frame and Sample size

All 240 Commercial rabbit producers and their closest neighbours in all villages of Hai District constituted a sampling frame. All commercial rabbit producers in eight villages of Hai Districts were selected and one closest neighbour for each commercial rabbit producer constituted a sample size. The unit of analysis was an individual study participant. The study involved 85 commercial rabbit producers and 85 non-rabbit producers in all eight villages making 170 study respondents.

D. Sampling techniques

A purposive sampling was employed to select Hai District because it is the headquarters of Saore Company Limited, which deals with commercial rabbit production in the country. Simple random sampling was used to select eight villages in which all 85 commercial rabbit producers in all eight villages were selected and one closest neighbour was selected for each commercial rabbit producer making 85 neighbours who are non-rabbit producers. Village Extension Officers, the District Extension Officers, two Saore Company Limited staff (the General Manager and the Production Manager), were purposively selected as key informants.

E. Data collection

The study used primary data, which were collected using questions in kobo Toolbox. Kobo Toolbox is intuitive and reliable software used to collect, analyse, and manage data for surveys and research. The tool enabled to take GPS location for each respondent during data collection for monitoring enumerators during data collection.

F. Data processing and analysis

A Statistical Package for Social Sciences (SPSS) computer program was used to analyse quantitative data. Binary logistic regression model was used to determine whether age, education level, sex, marital status, household size, and an average monthly income influence the adoption of commercial rabbit production. Qualitative data obtained through key informants were analysed using content analysis.

G. Ethical considerations

Participants were given responsiveness on the reasons for the study, and how imperative their involvement was for the study to be efficacious by receiving honest response. They were also guaranteed of confidentiality for

their responses and none was enforced or induced to respond. The research followed all the requirements of the research proposal, getting a research clearance letter from Sokoine University of Agriculture; and finally obtaining a research permit from the Ministry of Local Government in the United republic of Tanzania, Kilimanjaro Regional Office and Hai District Council Office in Kilimanjaro region respectively.

IV. RESULTS

Table 1: Demographic characteristics (N= 170)

Variables	Categories variable	Frequency	Valid Per cent
Age of Respondents	10 - 25	20	11.8
	26 - 41	66	38.8
	42 - 57	49	28.8
	Above 58	35	20.6
	Total	**170**	**100.0**
Education level	No formal education	5	2.9
	Primary education	66	38.8
	Secondary education	33	19.4
	Tertiary education	46	27.1
	University education	20	11.8
	Total	**170**	**100.0**
Sex of Respondent	Female	61	35.9
	Male	109	64.1
	Total	**170**	**100.0**
Marital status	Divorced	7	4.1
	Married	113	66.5
	Single	35	20.6
	Widow/widower	15	8.8
	Total	**170**	**100.0**
Household size	0 - 5	122	71.8
	6 - 10	44	25.9
	Above 11	4	2.4
	Total	**170**	**100.0**
Average monthly income(TSH)	0 - 200,000/=	66	38.8
	200,001/= - 400,000/=	20	11.8
	400,001/= - 600,000/=	17	10.0
	600,001/= - above	67	39.4
	Total	**170**	**100.0**

Table 2: Binary logistic regression results

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.176	.374	.223	1	.637	.838
Education	-.516	.297	3.022	1	.082	.597
Sex	.673	.630	1.142	1	.285	1.961
Marital	.084	.571	.022	1	.883	1.087
Householdsize	.714	.538	1.758	1	.185	2.042
Income	.807	.297	7.382	1	.007	2.242
Constant	-21.371	1.972E4	.000	1	.999	.000

V. DISCUSSION

A. Demographic characteristics of the respondents

This section discusses the demographic characteristics of the respondents, which included age, education level, sex of respondent, marital status, household size, and an average monthly income. The study results are presented in Tables 1 and 2.

1. Age of the respondents

The study sought to establish the age of the respondents in Hai District. The responses are shown in Table 1 on Demographic characteristics. The study findings showed that 20 (11.8%) respondents were in the age bracket of 10-25 years, 66 (38.8%) were between 26-41 years, 49(28.8%) were between 42-57 years, and 35 (20.6%) respondents were above 58 years. Therefore, study findings showed that 150(88.2%) respondents were above 25 years. This implies that the majority of the respondents were within and above the middle age and thus appropriate for commercial rabbit production, which involves commitment and active labour. According to binary logistics regression model in Table 2, the odds of the age of rabbit producer is 0.84 times less than is the case with non-rabbit producers. This implies that the age does not influence the adoption of commercial rabbit production in the study area. The study findings are in contrast with the findings in a study by Adams *et al.* (2021), who revealed that the age was statistically significant to technology adoption and social economic change. This study showed that teenagers and youths below 25 years were not actively involved in commercial rabbit production. On the contrary, a study by Appiah *et al.* (2011) in Ghana found that the adoption of rabbit technologies hinged on the ages; and aged people were more likely to adopt technologies than were the younger ones.

2. Education level of respondents

The respondents were asked to indicate their highest level of education. The results are shown in Table 1 which indicate that 5(2.9%) respondents had no formal education 66(38.8%) had primary education, 33(19.4%) had secondary education, 46(27.1%) had a tertiary education, and 20(11.8%) had university education. Thus, the study findings showed that 165(97.1%) respondents had formal education. Education is very important in the adoption of innovation by helping people to make decision. In this case, commercial rabbit is the new practice and educated people are likely to integrate the benefits associated with the same. The binary regression model results in Table 2 shows the change in odds of 0.6, thus the odds of education level for rabbit producer is 0.6 times less than that for non-rabbit producers. This implies that education level does not influence the adoption of commercial rabbit production in the study area. The findings contradict with the findings in a study by Nagar *et al.* (2021), which reported that educated farmers are open to search for new opportunities in striving for better standard of living and taking care of their loved ones than non-educated farmers.

3. Sex of the respondents

The respondents were asked to indicate their sex. The results are shown in Table 1, which indicate that 61(35.9%) respondents were females, 109(64.1%) were males. Having more male than female respondents does not mean that some households had males only. It is because more females were not at home by the time data were collected. In one of the key informant interviews, it was reported, "*female farmers are responsible for taking agricultural produce such as banana and vegetables to the markets and there are five market days in the week*" (key informant, Village Extension Officer Roo ndoo, May 10 (2023). That is the reason why there were more males than were female respondents in the study area. The model in Table 2 shows that the odds of sex for rabbit producers is 1.96 times higher than that for non-rabbit producers. This implies that sex influences the adoption of commercial rabbit in the study area. The study findings are consistent with the findings in a study by Abayomi *et al.* (2019) on demographic factors regarding customers' adoption of mobile banking service in Nigeria. The findings revealed that sex positively influenced the adoption mobile banking.

4. Marital status

In the study, the respondents were asked to state their marital status. The results are shown in Table 1 indicating that 7(4.1%) respondents were divorced, 113(66.5%) respondents were married, 35(20.6%) respondents were single, and 15(8.8%) r were widow/widowers. The study findings indicate that the majority of the respondents were married. Married farmers are likely to be ambitious in any productive ventures as they search a way for better standard of living for their families. This can facilitate the acquisition of new information and ideas among themselves than is the case with the ones who are not married. The models in Table 2 show that the odd of marital status for rabbit producer is 1.09 times higher than that of non-rabbit producers. This implies marital status influences the adoption of commercial rabbit production in the study area. The study findings agree with the findings in a study by Kusuma *et al*. (2020). The study looked at the adoption of information and communication technology among small and medium sized enterprises focusing on demographic characteristics in Asia. The findings revealed that marital status had a positive influence on the adoption of new technology; and that married people were more likely to adopt new technology than was the case with people in other categories of marital status.

5. Household size

The respondents were asked to indicate the number of individual they were living with in the same household. The results are shown in Table 1 indicating that 122(71.8%) respondents were living with fewer than 6 individuals, 44(25.9%) were living with between 6 to 10 individuals, and 4(2.4%) were living with above 11 individuals. The study findings indicate that the majority of respondents were living with fewer than 6 individuals in the same household. In addition, households with above 11 individuals had extended families where most individuals were grandchildren. The model in Table 2 shows that the odds of household size for rabbit producers is 2.04 times higher than that for non-rabbit producers.

6. Average monthly income

The study wanted to know the average income of respondents. The findings are shown in Table 1. The findings indicate that 66 (38.8%) respondents had an average monthly income of between 0 to 200,000 TSH; and 20(11.8%) had an average monthly income of between 200,001 to 400,000 TSH, 17(10%) had an average monthly income of between 400,001 to 600,000 TSH, and 67(39.4%) had an average monthly income of above 600,001 TSH. The study findings indicate that the majority (104(61.2%) of the respondents had an average monthly income of above 200,001 TSH. The findings indicate that the respondents, whose monthly income was above 200,001 TSH, were more likely to engage in commercial rabbit production than the respondents, whose average monthly income was below 200,000 TSH. In addition, one of the key informants from Saore Company limited was quoted saying,

> "*Commercial rabbit breed are a bit expensive with price per doe ranging from 240,000 to 440,000 TSH depending on the nature of the breed. The minimum investment cost to start a rabbit venture is 700,000 Tsh. this include one doe, one buck, one 25 kg bag of rabbit pellet, cage construction, and delivery fee to farmers' farm*" (Key informant interview, Production Manager Saore Company Limited, May 17,2023).

This implies that only those people who can afford having 700,000 Tsh are likely to start a commercial rabbit venture. The model in Table 2 shows that the odds of an average monthly income for rabbit producers is 2.24 times higher than that of non-rabbit producers. The findings agree with the findings in a study Abayomi *et al*. (2019) on the effects of demographic factors of customers' adoption of mobile banking services in Nigeria. The findings indicated that income level influenced the adoption of mobile banking. Customers who had high level of income were more likely to adopt mobile banking than customers who had low level of income.

VI. CONCLUSION AND RECOMMENDATION

A. CONCLUSION

From the study findings, it is concluded that, that age does not influence the adoption of commercial rabbit production in Hai District and thus, the null hypothesis is retained. Education level was found to have no influence on the adoption of commercial rabbit production and thus, the null hypothesis is retained. The findings revealed that sex had some influence on the adoption of commercial rabbit production, and thus, the null hypothesis is rejected. The findings also indicated that marital status does influence the adoption of commercial rabbit production, thus, null hypothesis is rejected. Furthermore, household size was found to have some influence on the adoption of commercial rabbit production, and thus, providing evidence of rejecting the null hypotheses. Similarly, average monthly income level was found to have some influence on the adoption of commercial rabbit production, and thus, providing evidence of rejecting the null hypotheses.

B. RECOMMENDATIONS

Based on the findings and conclusions of the study, it is therefore recommended that:

(i) To influence the adoption of commercial rabbit production in the study area; training on awareness creation on the benefits of commercial rabbit should be designed based on sex, marital status household size, and income.

(ii) To improve the adoption of commercial rabbit in the district the following people: younger, married, males and females, should be targeted during awareness creation on the importance of commercial rabbit.

(iii) To influence the adoption of commercial rabbit production in the Hai District male and female farmers should be targeted during awareness creation on the benefits associated with production of commercial rabbit production

(iv) To improve the adoption of commercial rabbit production in Hai District the average monthly income of farmer must be considered in advance. In addition, the average price of commercial breed should be considered for those household with low average monthly income to afford.

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