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Determinants of Paddy Farmers' Participation in Innovation Process in Mvomero District, Morogoro, Tanzania

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Abstract: ***Farmers' participation in rice innovations is an important platform for economic growth. However, information on the farmers' participation level in the rice innovation process in Tanzania is inadequate. Using a cross-sectional research design the study was conducted in Mvomero District, Morogoro, Tanzania to establish levels of farmers' participation in the rice innovation process. The study involved 299 randomly selected farmers from different plots of each scheme who participated in the innovation process. Data related to farmers' participation and their socio-economic characteristics were collected from paddy farmers using structured questionnaire. Data were analyzed using the IBM-SPSS program and STATA/SE software. The participation index was developed to measure participation levels and an ordinal probit regression model was used to determine factors influencing farmers' participation in the innovation process. Findings show that the overall level of farmers' participation by using a five-form participation typology was 61.9% which denoted a medium level. Ordinal probit regression results revealed that there were significant differences between the household size, farming experience, farm size, marital status, land ownership, extension advisory and farmer participation in the innovation process. It is concluded that the participation of farmers in the innovation process was medium meaning that farmers decision making in the inception and adoption of innovations was low. Also it is concluded that farmer participation in Mvomero District is determined by farm size, household size, farmer experience, marital status, land ownership and extension advisory. Extension workers should educate farmers on the benefits of the adoption of introduced innovations to advance farmers' participation in the innovation process. District land-use planners with collaboration to Dakawa and Mkindo village leadership are advised to monitor irrigation infrastructures to allow usability of marginal land proximity to irrigation schemes for farmers to expand their farm sizes since land is a key factor of paddy production.***

Keywords: *Innovation, adoption, participation, experimentation, stakeholders.*

1.0 Introduction

Rice is the staple food for most of the world's population and is increasingly becoming a strategic crop in most African countries, Tanzania being included due to its contribution to household income (Martey *et al*., 2013). Potential rice producing regions in Tanzania are Morogoro, Mwanza, Shinyanga, Tabora, Mbeya and Rukwa (URT, 2009). Paddy production in Tanzania is operated in different scale of production ranging from large, medium and small-scale farmers. The contribution of small-holder paddy production for food security and national economic growth should however not be overemphasized. In Tanzania small-scale paddy production is done through traditional and improved rice irrigation schemes. This study focuses on paddy production in irrigation schemes and the small-holder "improved" rice irrigation schemes in Tanzania include: Mbuyuni, Mabadaga, and Mwamapuli in Mbeya Region; Magozi, Mlenge, and Madibila in Iringa Region; and Mkula, Mkindo and Dakawa in Morogoro Region. Mkindo and Dakawa being amongst improved schemes are located in the Mvomero District of Morogoro Region. Introduction of innovations is important to paddy farmers as it is vital for increased paddy production and productivity.

Scholars (Rogers, 1995; Leeuwis, 2004) conceptualize innovation as an idea, practice, object or system that is perceived as new by individuals in a system In the agricultural sector, innovations create an array of new choices for producers, altering what is produced, where it is produced, and how it is produced (World Bank *et al*., 2009). Adoption and diffusion are the processes governing the utilization of innovations. Rogers, (1995) asserts that the innovation-decision process is a process through which an individual (or any other decision-making unit) passes from first knowledge of innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and confirmation of this decision. According to Pisante *et al*. (2012) the process of innovation includes not only knowledge creation, but also the whole system of technological diffusion, adoption processes, interactions and market adjustments. In this study, an innovation process is referred to as a course of action whereby innovation is exposed to farmers by researchers or extension agents and its eventual utilization by farmers.

The participation of various actors in the innovations process is necessary for agricultural growth (Ghimire, 2009). Different scholars have looked into the concept of participation differently and their views have not focused on the differential degree of involvement of each actor in an

intervention. According to Cornwall (2008), a 'deep' and 'wide' participatory process engages a range of participants at all stages of a particular activity from identification to decision-making. Leeuwis (2004) defines participation as a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them. Cornwall (2008) looked at participation in the context of engagement of various actors with varying perceptions of the meaning of participation in the participatory process. Scholarly discourses on the concept of participation dwelt on elaboration that different actors take part in the implementation of development intervention but there is a need to emphasize the differential participation of each actor. According to Martey *et al.* (2013), participation is a necessary but not a sufficient condition for the adoption of an innovation.

In line with the concept of participation, one would expect to realize the innovation process to entail a 'full' or total commitment to inclusiveness from the development, inception and adoption of new ideas among the actors including end-users (farmers). The low participation of farmers in any agricultural development project could be due to the inability of the project to meet the production needs of those farmers.

The idea of 'maximum participation' connects to a notion that there are different levels of participation (Leeuwis, 2004). Literature show that there are different "forms" within each typology of farmers' participation in rural innovations (Johnson *et al*., 2003; Kumba, 2003; Leeuwis, 2004; Iqbal, 2007; Ghimire, 2009). But little is known on the level of farmers' participation in each form of particular participation typology.

Sumberg *et al*. (2003) asserts that farmers are viewed as passive recipients of technology whereby all is needed is communication and information flow in a linear and unidirectional way from the researchers to the farmers, via the extension. In line with Sumberg *et al*. (2003) and Noltze *et al*. (2011) farmers participate in System of Rice Intensification (SRI) training at the level of receiving information where extension services announce SRI via local radio stations or demonstration sites. There is a need for more integration of farmers in the innovation processes through greater participation and determining the most effective ways of promoting farmer participation in the innovation process.

This study adapts a five-form typology of farmer participation in the innovation process as used by Johnson *et al*. (2003) (Table 1.0). The adaptation customized into farmers participation rather than considering community participation in general. The five forms of participation in this typology are: conventional, consultative, collaborative, collegial and farmer experimentation.

This typology is selected due to its precision and clearly defined forms of participation. Each form of participation within the typology clearly describes the position of farmers in decision making and organized communication between farmers and scientists/researchers/extension agents upon introduction and adoption of innovations (Table 1.0).

Table 1.0: Typology of participation

Form	Characteristics in each form
Conventional (No farmer participation)	Scientists/researchers/extension agents make decision alone without organized communication with farmers. It entails the launching of an innovation to farmers. Scientists/researchers/extension agents are much less inclined to engage farmers in the introduction of innovations.
Consultative (Functional participation)	Scientists/researchers/extension agents make decisions alone, but with organized communication with farmers. Farmers participate by being consulted through forums/meetings where they express their views and opinions but they are not final decision-makers on the innovations.
Collaborative (Empowering participation)	Decision-making authority is shared between farmers and scientists/researchers/extension agents, and involves organized communication between them. Farmers are actively involved by taking control and influence the decision-making process. There is joint involvement of stakeholders.
Collegial (Empowering participation)	Farmers make decisions collectively in a group of people who are involved in organized communication with scientists/researchers/extension agents. Farmers take initiatives in promoting innovation and assume responsibility for carrying it successfully.
Farmer experimentation (No researcher participation)	Farmers make decisions collectively in a group without organized communication with scientists/ researchers/ extension agents. Farmers are responsible for customizing the technology to suit their farming conditions. Farmers do experiments and then use technology for their needs and circumstances.

Adapted from Johnson *et al*. (2003).

Since independence, the Government of Tanzania (GOT) has been making various efforts to promote the agricultural sector by assuring farmers' access to and utilization of innovations and other resources. Most efforts have been focusing on achieving quality livelihoods in terms of increased production and productivity (URT, 2009; URT, 2013). Most of these efforts have not paid much attention as to which extent farmers participate to the innovations process as innovations are constantly being introduced to their areas. Innovations which were introduced in Mvomero District where this study was conducted are: System of Rice Intensification (SRI), power tillers (PT), wooden threshers (WT) and Combined Rice Mills (CRM) (Katambara *et al*., 2013). Studies show that poor farmers, especially the rural ones, do not fully participate in the innovations process (URT, 2009; World Bank *et al.*, 2009; Paris *et al*., 2011). This study therefore established farmer participation level in the innovations process in Mvomero District, Morogoro Region of Tanzania. Specifically, the study aimed at determining the extent to which rice farmers participate in a five-form typology of participation in the innovation process. In addition, the study analyzes factors influencing farmers' participation in the rice innovations process.

2.0 Theoretical Framework and Debate

This study is guided by Rogers's theory (1995) of diffusion of innovation. The theory identifies various factors for adoption of innovation. Factors can be grouped in innovation characteristics, adopter's characteristics and external factors. In innovation related characteristics, Rogers insists on five key qualities that determine the rate of an innovation adoption to be relative advantage, compatibility with existing values and practices, simplicity and ease of use, trialability, and observable results. Therefore these qualities dictate to which extent paddy farmers can participate in the introduced innovations to their setting. Despite qualities related to innovation characteristics, Rogers (1995) further argued that farmer's decision to adopt or reject an innovation is a mental process which takes place in an individual, thus in this case,

for paddy farmers to accept or reject the paddy innovations, it depends on how paddy farmers perceive a given innovation in their own view on their felt needs and prior experiences (Meijer *et al.*, 2014). Thus, it is argued that farmers' perceptions over innovation process are determined by personal characteristics such as age, education, attitude, experience and extension services (Rehman *et al.*, 2007). Thus, basing on this theory the study analysed how the selected innovations were adopted by paddy farmers in the study area; also it analysed how the introduction of paddy innovations in Mvomero District influences farmers' participation in the innovation process.

3.0 Methodology

The study was conducted in Mkindo and Dakawa paddy irrigation schemes in Mvomero District, Morogoro. Mkindo and Dakawa rice irrigation schemes were the first adopters of SRI among the smallholder paddy farmers in Tanzania and served as good sites for the study on the adoption of SRI. Given the study population of 1 192 farmers participating in two schemes, the sample size of 299 farmers was estimated by using Yamane (1973). Proportionate samples of 96 and 203 farmers from Mkindo and Dakawa respectively were obtained. The farmers who constitute the sample size of the study were selected using a simple random sampling technique from different points in each irrigation scheme. Data were collected only at once by using a structured questionnaire to generate information related to farmers' participation and their socio-economic characteristics.

Levels of participation were established by using quantitative methods of data analysis. Statements representing conventional (9), consultative (4), collaborative (4), collegial (4) and farmer experimentation (4) forms of participation were graded on a five-point Likert scales of 'strongly agree', 'agree', 'disagree', 'strongly disagree' and 'undecided' with 4, 3, 2, 1and 0 scores respectively. The distribution of statements across stages varies depending the number of characteristics in each stage. Then a participation index was developed for each stage of participation as well as the overall participation. This means there were 6 participation indices, 5 for each stage and the sixth one for overall participation.

The following formula was used;

$$PIndex = \frac{Tscore}{Maxscore} x100.$$

Where:

$PIndex$ =Participation index

$Tscore$ =Total score obtained

$Maxscore$ =Maximum possible score.

This approach was also used by Rao *et al.* (1992) as well as Fita and Trivedi (2012). Thereafter, in order to obtain cut points, the participation levels were categorized using mean and standard deviation (SD) into: Low = < (mean - SD), Medium = between (mean - SD) to (Mean + SD) and High = > (Mean + SD).

An ordinal probit regression model was used to analyze the determinants of the farmers' participation levels in the innovation process. Ordinal dependent variable Y is representing levels of participation in innovation process where 1=low participation, 2=medium participation and 3=high participation, of some underlying latent variable Y^*. We assume that $Y_i^* = X_i\beta + \mu_i$ and that we observe the ordinal choice Y_i :

$$\begin{cases} 0 & \text{If } Y_i^* \le 0, \\ 1 & \text{If } 0 < Y_i^* \le \mu_1 \\ 2 & \text{If } \mu_1 < Y_i^* \le \mu_2 \\ 3 & \text{if } \mu_2 < Y_i^* \end{cases}$$

Where:

Y^*= latent variable.

β =Estimated coefficients of the respective explanatory variables

μ_i = Error terms, is normally distributed and is used to estimate β vector and the thresholds μ corresponding to the different levels of the variables.

X_1 = Age (years)

X_2 = Household size (number of people)

X_3 = Farming experience (years in farming)

X_4 = Farm size (Ha)

X_5 = Farm income (Tzs)

X_6 = Sex (Male 1, otherwise 0)

X_7 = Marital status (married 1, otherwise 0)

X_8 = Land ownership (Owned 1, otherwise 0)

X_9 = Extension advisory (Yes 1, otherwise 0)

X_{10} = Labour availability (Hired 1, otherwise 0)

The estimates for the parameters were obtained by using STATA/SE software version 12.0 through which data were transferred from IBM-SPSS program. The relative effect of each explanatory variable on the likelihood that a farmer participated in innovation process at either low, medium or high level is given by the marginal effect formula; $\frac{\partial P_i}{\partial \chi_{ij}} = \beta_{ij} * f(Z_i)$, where $f(Z_i)$ is the inverse of the cumulative normal function and β_{ij} are the estimated parameters.

Description of Explanatory Variables

Age is expected to influence participation negatively. Younger farmers are more willing and dynamic than older ones to participate in the innovation process (Hartwich and Scheidegger, 2010). Sex of the farmer is expected to depict the difference in enthusiasm between male and female farmers to participate in the innovation process. According to Martey *et al.* (2013) females are normally confined with accomplishing domestic activities which deprive them of the opportunity to participate in the innovations compared to males. In another hand, married farmers are more likely to participate in the innovations as their spouses normally help them to carry out production activities and make a decision.

Farmer experience is expected to influence participation in the innovations positively. Pedzisa (2016) established a positive relationship between farming experience and farmer participation. Experienced farmers normally use their experience gained over the years to assess the attributes of innovations. Farm size is expected to influence participation positively. A farmer with large farm size can spare proportion of the whole farm land to try an innovation availed to farm setting.

Household size is posited to positively influence head of the household to participate in the innovations. Availability of household members provides the head with the opportunity to share the responsibilities related to adoption of innovation. Scholars (Botlhoko and Oladele, 2013; Martey *et al*., 2013) have found a positive relationship between the household size and participation in the innovations. Extension advisory is expected to positively influence farmer to participate in the innovations. Extension advice helps farmers to be aware on the potential benefits of using innovations (Howley *et al*., 2012). Land ownership status is expected to capture the difference in decision to participate in the innovations between the owners and non-owners of land used for rice production. Farmers with full ownership to land are more willing to try and practice innovations than non-owners of land.

4.0 Findings and Discussion

4.1 Socio-Economic Characteristics of the Respondents

The household size may serve for labour supply for farm and non-farm activities provided that age distribution favours labour force. In this study it was found that 65.2% of all respondents had household size ranging 1-5 members (Table 2). However, it is common for the rural farming communities to have large households due to the fact that people tend to live in extended family which is supportive in farm labour provision. The findings revealed that 51.5% of farmers in the study area had farms size ranging between 1to 5 hectares with an indication that farmers could spare part of their fields to practice the rice innovations.

Table 2: Socio-economic variables (n=299)

Variable	Frequency	Percent
Household size (Number of persons)		
1-5	195	65.2
6-10	100	33.5
>10	4	1.3
Farm size (Hectares)		
< 1	140	46.8
1-5	154	51.5
6-10	5	1.7
Farming experience (years)		
<5	73	24.4
5-10	116	38.8
11-15	38	12.7
16-20	39	13
>20	33	11
Age (Years)		
<25	20	6.7
25 – 34	65	21.7
35 – 44	92	30.8
45 – 54	82	27.4
55- 64	30	10.0
>64	10	3.3
Sex		
Male	200	66.9
Female	99	33.1
Marital status		
Married	222	74.2
Not married	77	25.8
Land ownership		
Owned	89	29.8
Borrowed	166	55.5
Hired	44	14.7
Extension advisory		
Received	69	23.1
Not received	230	76.9
Farm labour availability		
Hired	182	39.1
Not hired	117	60.9

Findings further show that 58.2% of the respondents were in the energetic and economically active age category which is useful in undertaking rice farm production and processing responsibilities like cultivation, weeding and carriage of luggage. In this study, there were 66.9% male respondents. Males are more dynamic and therefore can easily be exposed to new ideas compared to females. However, majority of respondents (74.2%) were married and being into marriage status, the partners can assist each other to accomplish family and farm activities. In relation to land tenure, this study shows that 55.5% of all respondents tend to borrow land from farmer association upon registration especially in Dakawa irrigation scheme and 60.9% of all respondents do not offer their labour for hire. Farmers who offer their labour for hire means they spend their entire time to off-farm activities which is a constraint for them to access opportunities attached to innovations and lowers their participation to extension services. 76.9% of respondents did not receive extension advisory which made it difficult to access and utilize the introduced rice innovations.

4.2 Levels of Participation

High participation of farmers in the introduction and adoption of agricultural innovations is an important platform because farmers are the ultimate beneficiaries of innovations (Emond and Madukwe, 2010). This study revealed that participation of smallholder rice farmers in the study area was below 45.1% for conventional, 49.0% for consultative, 48.4% for collaborative and 46.6% for collegial form, while it was slightly higher for farmer experimentation form (55.9%), whereas the overall farmer participation in innovation process was 52.0% (Table 3).

The results indicate that farmers' participation in each of the five participation typology as well as the overall participation for five forms, was rated at medium level. This implies that farmers' involvement in decision-making in the innovation process was at the medium level and may have an impact on the final use of innovations. Kumba (2003) found that farmers' participation in agricultural programs was too low (below 30%).

Table 3: Levels of participation (n=299)

Forms of participation	Levels of participation	Frequency	%	Participation (%)
Conventional	Low (<28.6%)	35	11.7	45.1
	Medium (28.6- 72.1%)	189	63.2	
	High (>72.1%)	75	25.1	
Consultative	Low (<12.8%)	98	32.8	49.0
	Medium (12.8 - 67.4%)	135	45.2	
	High (>67.4%)	66	22.1	
Collaborative	Low (<13.4%)	85	28.4	48.4
	Medium (13.4 - 66.8%)	160	53.5	
	High (>66.8%)	54	18.1	
Collegial	Low (<12.3%)	77	25.8	46.6
	Medium (12.3 - 65.4%)	178	59.5	
	High (>65.4%)	44	14.7	
Farmer Experimentation	Low (<14.3%)	99	33.1	55.9
	Medium (14.3 - 69.9%)	161	53.8	
	High (>69.9%)	39	13.0	
Overall level of participation	Low (<18.8%)	81	27.1	52.0
	Medium (18.8- 65.8%)	185	61.9	
	High (>65.8%)	33	11.0	

Relatively lower participation of farmers at conventional compared to other forms of participation implies that the introduction of the innovations in the study area was vested to scientists and experimentation was mainly done by

farmers themselves. The relatively higher participation at farmer experimentation means that it is a form of participation where innovation is tested in the inclusion of farmers and the attributes of such innovation are easily realized by farmers themselves. Findings from this study are similar to that by Johnson *et al*. (2003) who found no farmer participation at the conventional form and also no researcher participation at farmer experimentation form but there is a mixed interaction of farming stakeholders at other forms of participation. This difference implies that researchers and extension workers interacted with farmers through shared communication during the inception and utilization of respective innovations in the study area.

4.3 Determinants of Farmers' Participation in the Innovations Process

The signs of coefficients from ordinal probit regression analysis were used to discuss the direction of the relationship (positive/negative) between explanatory variables and the dependent variable. Based on the ordinal nature of the dependent variable, this study used marginal effects to discuss the magnitude of change of dependent variable with respect to change of explanatory variables.

Household members form the basis of family and farm labour. The result from this study shows that household size was statistically significant at p<0.05 level and positively influenced the participation of farmers in the innovation process (Table 4). Marginal effects results were found to be -.0233965, .0110524 and .0123441 for low, medium and high levels of participation respectively (Table 4). This indicates that an increase of one member in a household increases the likelihood of participation in the innovation process by 0.011 at medium level and by 0.012 at a high level but decreases the likelihood of participation at a low level by 0.23. This implies that large household size enabled members to share farm responsibilities and created an opportunity for a farmer to participate in the innovation process and it was vice versa for the households with relatively fewer members. In this study, an increased member of the households offered an opportunity to access and adopts innovations. The study finding coincides with Kefyalew (2013) who found that farmers who have access to more family labour are more likely to participate in agricultural production activities, but Pedzisa (2016) found that household size negatively impacted the adoption of agricultural innovation.

Farming experience measured in years was statistically significant at p<0.1 level and had a negative relationship with farmer participation in the innovation process. This results show that marginal effects were 0.006, -0.003 and -0.003 for low, medium and high levels of participation respectively (Table 4). This indicates that increasing one year in farming experience increases the likelihood of a farmer to participate in the innovation process at low level by 0.006 while decreases the likelihood of a farmer participating in the innovation process by 0.003 at the medium as well as at high level (Table 4). The study findings imply that farmers with low farming experience had high participation in the innovation process but farmers who had high farming experience had low and medium participation to the innovation process.

Table 4: Results of the ordinal probit regression analysis

Variables	Coefficients	Z-statistic	Marginal effects for low participation	Marginal effects for medium participation	Marginal effects for high participation
Household size (number of persons)	.0725893**	1.98	-.0233965	.0110524	.0123441
Farming experience (years)	-.0191239*	-1.88	.0061639	-.0029118	-.0032521
Farm size (Ha)	.1680032***	3.34	-.0541497	.0255801	.0285697
Marital status (1=married)	-.3434029*	-1.84	.1042272	-.0391912	-.065036
Land ownership (1=Owned)	.3196402*	1.93	-.0983535	.0391958	.0591577
Extension advisory (1=Yes)	.2808704*	1.65	-.0857875	.0331292	.0526583
No of observation		299			
Log likelihood		-252.62169			
LR chi2 (10)		29.42			
Prob > chi^2		0.0011			
Pseudo R^2		0.0550			

Key: ***, ** and *: Significance at 1%, 5% and 10% respectively

This is based on the fact that farmers who spent fewer years in rice production are more ambitious to learn on rice innovations due to high expectations over respective innovations but they become more reluctant to accept innovations when they become more used to innovations. Ani *et al.* (2004) found similar results that farmers with high experience are usually older, uneducated and reluctant to change than new entrants. Pedzisa (2016) established a positive relationship between farming experience and the adoption of agricultural innovations.

The farm size of the respondents was statistically significant at p<0.01 level and positively influenced farmer participation in the innovation process (Table 4). Marginal effects results were -.0541497, .0255801 and .0285697 for low, medium and high levels of participation respectively (Table 4). This means an increase in a farm size by one hectare decreases the likelihood of a farmer to participate at a low level by 0.05 but increases the likelihood of farmer participating by 0.03 at medium level and by 0.03 at high level in the innovation process. This implies that a farmer with relatively bigger farms in size stands a good chance to practice rice innovations and vice versa is true. Similar to this study's finding, other researchers have found a positive relationship between farm size and adoption of innovations (Noltze *et al*., 2011; Singha *et al*., 2012; Howley, Donoghue and Heanue, 2012).

The finding shows that marital status was statistically significant at p<0.1 level and displayed a negative coefficient. Marginal effects results were found to be .1042272, -.0391912 and -.065036 for low, medium and high levels of participation respectively (Table 4). This denotes that married farmers had 0.1 more likelihood to participate in the innovation process at low level, but less likelihood to participate in the innovation process at medium and high levels by 0.04 and 0.07 respectively (Table 4). The result implies that unmarried farmers have higher participation compared to married ones. Unmarried farmers are not more tied to family responsibilities than married farmers and therefore enhance their involvement in the innovation process. This study's finding conforms to that of Martey *et al*. (2013) who found that marital status based on married ones had significant and negative influence on participation

in rural development programmes and marital responsibilities being a reason to such relationship.

Land ownership status was statistically significant at p<0.1 level and had a positive influence on farmer participation in the innovation process. Marginal effects results were -0.10, 0.04 and 0.06 for low, medium and high participation levels respectively (Table 4). Land ownership is associated with farmers being 0.10 less likely to be in low participation level, but 0.04 and 0.06 more likely to be in medium and high levels of participation respectively. The findings imply that farmers are more likely to participate in innovation process when they have ownership of land than those who hire or borrow land for rice production. Findings suggest that farmers who own land had high participation status due to feeling more ownership and thus willing to try/and practice innovations. Finding of Soule *et al*. (2000) corresponds to this study finding, they found that renters are less likely than land owners to adopt agricultural practices.

Extension service offered to farmers was statistically significant at p<0.1 level and had positive relationship with farmer participation in the innovations process. Marginal effects were -0.08, 0.03 and 0.05 for low, medium and high participation respectively (Table 4). The study findings imply that participation increases with farmers who received extension services on introduced innovations in the study area. Increase in extension service delivery increases the likelihood of a farmer to participate in the innovation process at medium and high levels by 0.03 and 0.05 respectively, but decreases the likelihood of a farmer to participate in the innovation process at low level by 0.08. Farmers who do not get access to extension services are thus marginalized and denied with important knowledge on introduced innovations, therefore, they eventually experience low level of participation. But farmers who access extension services, are equipped with knowledge about introduced innovations and thus built willingness to try/and adopt such innovations among farmers. Howley *et al*. (2012) and Sjakir *et al*. (2015) found that extension advises positively influence farmer participation to innovations.

5.0 Conclusion and Recommendations

Participation of rice farmers in the five-form participation typology was medium. Generally, the decision on the introduction and adoption of the innovations were vested to scientists and extension agents. Probit estimates revealed that important factors influencing participation of rice farmers in the innovation process in Mvomero District are household size, farm size, farmer experience, marital status, land ownership and extension advisory. Land ownership has a potentially incentives on the participation of farmers in the innovation process. Also extension services impart farmers with the knowledge and skills related to innovations.

To enhance participation of the rice farmers in the innovation process it is recommended that scientists and extension agents should teach farmers on the benefits of adoption of innovations introduced to their setting. This study, further, recommends that land-use planners at the District level in collaboration with Dakawa and Mkindo village leadership to make follow up on schemes to ensure the drainage system is not problematic to allow effective rice production operations. This will aid in uncultivated land to be usable whereby farmers will increase their farm sizes and be able to try/and practice innovations. Also, it is recommended that the irrigation schemes' leadership through agricultural land use planning section in the Ministry of agriculture, livestock and fisheries should facilitate farmers' acquisition of legal ownership of agricultural land. Again, it is recommended that training division in the Ministry of Agriculture, livestock and fisheries should offer constant training to extension workers to keep them up-to-date to new ideas/practices, be competent and strengthen their service delivery.

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Conflict of interest

The authors declare that there is no conflict of interest during the review and publication of this manuscript.

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