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A Logit Analysis of Factors Affecting Adoption of Fish Farming in Malawi: A Case Study of Mchinji Rural Development Program

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Abstract: This study was conducted to investigate factors that affect adoption of fish farming in Mchinji Rural Development Program, in the central region of Malawi. Using logit analysis the study showed that sex, age, *dimba* (wetland) size and livestock ownership were important parameters in determining the adoption of fish farming. The results suggest that in promotion of fish farming, an integrated approach must be adopted. The nutrient rich water from the fish ponds could be used in irrigating vegetables while some waste vegetables could be fed to the livestock that provide manure to the fish ponds. Fish farming development programs should deliberately target women to bring them into the main stream of development.

Key words: Adoption, fish farming, logistic regression, Malawi, small holder farmer

INTRODUCTION

In Malawi, fish production from aquaculture is estimated at only 500 mt per year with small holder farmers producing 80 mt while commercial fish farmers and small water bodies producing 360 and 60 mt, respectively. Aquaculture contributes about 0.07% of the total fish production in Malawi[1]. However fish farming is of great social and economic significance and has high potential in Malawi. Fish farming, particularly when integrated with agriculture, may enhance cultivation of marginal lands; recycling of crop residues as pond inputs, use of fishponds as water catchments points for irrigation, processing of crop waste and livestock waste into fertilizer and control water supply thereby reducing floods[2]. Under drought conditions, ponds may contain some residual moisture in bottom soils where vegetables can be produced for food and income throughout the year. Fish farming actually enhances income of rural people because of the high demand for fish[3].

Despite the numerous positive issues on fish farming, its adoption is relatively low. Based on land formations, altitude, temperature and precipitation, it is estimated that 11,650 km^2 has potential for fish farming in Malawi[4]. However, currently only less than 1% is used for fish farming. Factors impinging on the development of fish farming especially among small holder farmers were not known. Therefore this study was designed to investigate factors that influence adoption of fish farming. Mchinji Rural Development program was chosen because the area has perennial rivers which would supply water to the fish ponds throughout the year. Secondly, many fish farming development projects have recently concentrated in Mchinji area and unless the limiting factors are identified, these efforts are bound to fail.

MATERIALS AND METHODS

Primary and secondary information were used in the study. A survey was conducted in Mchinji in using a questionnaire with open-ended questions. The study was conducted from February-May, 2003. A total of 76 fish farmers and 76 non-fish farmers were interviewed. The data collected in the survey mainly included; gender, age, marital status, family size, land holding size, educational qualification and land holding size. The data for the two groups were compared to see if there were significant differences in the socio-economic variables.

The socio-economic variables for the two groups were examined using logistic regression model[5]. The dependent variable was dichotomized with a value 1 if a farmer was an adopter of fish farming and 0 if otherwise. The independent variables included sex of the household, age of household head, education status of household head, socio-economic status of household, extension contact, family size, land ownership, *dimba* ownership, *dimba* size, livestock ownership and taboos. Farmers along perennial rivers were purposely sampled as they had water which is a very important factor in fish farming. The model was specified as follows;

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Y = *f*(SXHD, AGHD, EDST, SSHD, EXCT, FMSZ, LHSZ, FMLB, FAMSZ, LVWN, DBWN, TABS)

Where:

Y = Dependent variable
SXHD = Gender of the household head
AGHD = Age of the household head
EDST = Educational status of household head
SSHD = Social status of household head
EXCT = Extension contact
FMSZ = Family size
LHSZ = Land holding size
FMLB = Family labor available
FAMSZ = Farm size
LVNM = Livestock ownership
DBWN = *Dimba* (wetland) ownership
DBSZ = *Dimba* size
TABS = Taboos against fish from fish farming

SXHD, EDHD, SSHD, EXCT, DBWN, LVNM and TABS were entered in the model as dummy variables. The other variables namely AGHD, FMLB, FMSZ, LHSZ and FMSZ were entered as continuous variables.

During model estimation FMSZ collated highly with FMLB and thus was dropped. DBWN was also dropped because it was insignificant factor in the model. The final model included the following; SXHD, AGHD, SSHD, EDST, EXST, FMLB, LHSZ, DBSZ, LVNM and TABS.

RESULTS AND DISCUSSION

In Table 1 the parameter estimates suggested that age, sex, *dimba* size and livestock ownership are key factors affecting adoption of fish farming.

Evaluation of the model: The model is appropriate for the data because of two reasons. Firstly, it is because its chi-square (goodness of fit) is significant at $p<0.001$. This implies that the independent variables that were chosen are able to explain the variations in the dependent variable. Secondly, the model's prediction of success of 69.90% is relatively highly meaning the model is able to explain about 70% of the factors that influence a farmer to adopt fish farming.

The influence of gender in the adoption of fish farming: The analysis has shown that there a negative relationship between the probability of adoption of fish farming and sex of the household head. The study found that the probability of women adopting fish farming is low although it is easy to manage fish ponds. One possible explanation is the labor requirement in the construction of fish ponds and harvesting of fish, since most people rely on family labor. Women might find it hard to perform the two tasks leading to low adoption. It has been also observed that most rural women do not own factors of production and are illiterate which hinders them from adopting new methods of farming[6]. Most extension meetings are patronized by men and women do not have access to the required knowledge for fish farming.

Table 1: Logistic regression coefficients of the factors affecting adoption of fish farming business

Variables	Coefficient	SE	t-value
Constant	9.5599	20.8219	0.6461
SEXHD	-1.4852	0.8266	0.0724**
AGHD	0.0306	0.0176	0.0823**
SHD	-0.3203	0.745	0.6672
EDHD	0.9064	0.6036	0.1332
EXCT	0.1922	0.4362	0.6594
FMLB	0.0348	0.1429	0.8074
LHSZ	0.1181	0.1313	0.3683
DBSZ	0.6761	0.3598	0.0602**
LVWN	1.3389	0.6598	0.0424*
TABS	7.0424	20.7885	0.7348

*significant at $p<0.05$, **significant at $p<0.10$, -2 Log likelihood = 144.197
Goodness of fit = 121.050, Prediction of success = 69.60%

The influence of age on adoption: The model showed a significant positive relationship between age of the household and the probability of adoption of fish farming ($p<0.10$). In the study the majority of farmers who adopted fish farming were in the age of between 30 and 49 years. It has been observed that relatively younger people for example 30-49 years are risk takers relative to older people. The young people are more exposed than old people and can easily adopt new technology. On the other hand, although older farmers may be less inclined to try new farm practices, they have more access to land, income and other resources[7].

The influence of the size of *dimba* on adoption of fish farming: The study revealed that the size of *dimba* is a key factor in the adoption of fish farming ($p<0.05$). In Malawi, land holding sizes are small and about 56% of the small holder farmers cultivate land holdings that are less than 1 ha. The decrease in land resources against the ever increasing human population has given way to cultivation of unsuitable and marginal areas such as *dambo* areas[8]. *Dimba's* are cultivated for vegetables and other crops such as maize after the rainy season. However integrated agriculture-aquaculture might maximize the use of these places. Ponds do not take much space (approximately 100 m^2) and these would act as water reservoir in summer. The highly fertilized water would be very important for vegetable production producing products not only at a cheaper cost but also environmental friendly. Therefore

the innovations being promoted to the farmers should be an integrated agriculture-aquaculture production system. Advocating only fish farming may result in low adoption.

The influence of livestock ownership in adoption of fish farming: In this study, livestock ownership was also noted to affect the decision to adopt fish farming. Farmers that have livestock are more likely to take up fish farming than those that do not have any livestock (holding all the other factors constant). Most farmers use livestock manure for their crops, vegetable gardens and fish ponds[9]. Therefore when promoting fish farming, livestock husbandry should be included. Since those farmers without livestock feel they cannot adopt fish farming, the development project in the area could supply small ruminants or poultry on loan basis. They could pay back later after selling their fish.

Problems with fish farming in Mchinji: Although it has been stated that the Mchinji area has great potential for fish farmers, there are some problems faced by fish farming adopters. Addressing these problems is very crucial to avoid some farmers drop out. These problems include:

Lack of technical know-how: Most of the fish farmers did not have adequate knowledge in fish farming especially on feeding and stocking densities. Most of the ponds in the area (60%) were under-fertilized and low or high stocking density leading to slow growth of fish. This might later make the farmers feel its not profitable to raise fish and consequently might decide to drop out. There is need to have training meetings to remind the fish farmers correct feeding regime and stocking density.

Lack of extension staff: There is no fish farming extension staff for fish farmers in the area. The government official from another area (100 km away) is the one who visits the area. The frequency of their meetings might be once in three months as the officer has no reliable means of transport. If the government would like to promote fish farming, each area should have an extension staff. Another feasible suggestion would be that since there is an agricultural extension staff in the area, these agricultural extension staff could be trained in fish farming to help the farmers in fish farming. This would be part of enhancing agricultural productivity on a small piece of land.

Lack of fingerlings: The farmers do not have access to readily available fingerlings. The source of the fingerlings is usually from a government station located 300 km away. This proves to be expensive in terms of transportation and mortality is high due to high stress that the fingerlings are subjected to. Although the government provides transport, this is not sustainable as the transport might not be available when required. The Fisheries Department must train some farmers in the area to produce fingerlings who in turn sell to other farmers once they produce them. This is the most sustainable way of fish farm production.

CONCLUSIONS

The results from this study have significant implications on fish farming development in Malawi. It has been noted that promoting fish farming alone while isolating other agricultural activities might not work. Therefore integrating agriculture, fish farming and livestock production may help farmers adopt fish farming. As already seen livestock is a catalyst for fish farming and hence should be promoted. This requires a holistic approach. The cooperation and coordination with other agencies like agriculture and non-governmental organizations may be essential. This is also a challenge to extension staff as they will be required to assist both in agriculture production as well as fish farming. This requires re-training the extension staff to let them acquire new knowledge in face of the new challenges.

Since women were less likely to adopt fish farming, deliberate effort should be made to reach out to these women as a way of empowering them. Women, especially those who are household head, must be involved in food production to ensure food security for their families. Training women in fish farming would assist in bringing in confidence they lack due to their low level education.

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