Factors affecting adoption of fish farming in Malawi: A case of Mchinji Rural Development Programme

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Abstract

When integrated with agriculture, rural fish farming can socially and economically transform smallholder farmers in Malawi. While the government of Malawi and its donor partners have intensively promoted fish farming, few smallholder farmers have adopted the technology. This study was conducted to investigate factors that affect adoption of fish farming in Mchinji Rural Development Programme, in Central Malawi. Data were collected on 76 fish farmers and 76 non-fish farmers using structured questionnaires. Results from logistic regression showed that sex, age, *dimba*-size and livestock ownership were important parameters in determining the adoption of fish farming. Age, *dimba size* and livestock ownership were positively related to adoption of fish farming while sex was negatively associated to the adoption of fish farming suggesting that the older the person, the larger the *dimba* and those with more livestock are likely to adopt fish farming. On the other hand males are more likely to adopt fish farming than female farmers.

Key words: Malawi; Adoption; Logistic Regression; Fish farming; Smallholder Farmer.

Introduction

In Malawi, production of fish from aquaculture is estimated at 500 tonnes with small-scale farmers producing 80 tonnes while small water bodies and commercial fish farmers producing 60 and 360 tonnes respectively, representing 0.07% of total fish production in (Sikawa *et al.* 2000). Fish farming is of great social and economic significance to Malawi. Fish farming, particularly when integrated with agriculture may enhance cultivation of marginal land; recycling of crop residues as pond inputs, use of fishponds as water catchments points for irrigation, domestic and livestock, processing of crop waste into fertilizer mud and control of water supply thereby reducing floods. Under drought conditions, ponds may contain some residual moisture in bottom soils where vegetables can be produced for food and income throughout the period (Lightfoot and Noble, 1992, Pullin *et al.* 1995, Noble, 1996, Verweiji 2001). In addition, fish farming can greatly enhance income of rural people (Kapalamula 1993, Prein *et al.* 2000).

Despite the numerous positive activities on fish farming, its adoption is relatively low. Based on land formations, altitude, temperature and precipitation, Brooks (1992) estimated that 11650km^2 of land has potential for fish farming in Malawi. However, currently only less than 1% is used for fish farming. Worse still, factors that influence adoption of fish farming are not known. This study therefore was designed to investigate factors influencing adoption of fish farming in Malawi. It was hypothesized that sex, age, social status, educational status, extension contact, family labour, land ownership, land size, *dimba* ownership, *dimba* size, family size, livestock ownership and taboos are the main factors affecting adoption of fish farming.

Methodology

Primary and secondary information (published and unpublished literature) were used in the study. A survey was conducted in Mchinji Rural Development Programme between December 2002 and February 2003 using structured questionnaire with open-ended questions. A total of 76 fish farmers and 76 non-fish farmers respectively, were interviewed.

Factors affecting adoption of fish farming were examined using a logistic regression model. The dependent variable, adoption of fish farming was dichotomised with a value of 1 if a farmer was an adopter of fish farming and 0 otherwise as used by Egri (1999), Masangano (2003), Thangata *et al.* (2003) to examine similar issues for various technologies in different areas. The independent vari-

ables included sex of household head (**SEXHD**), age of household head (**AGEHD**), education status of household head (**EDCST**), socio-status of household head (**SSTAHD**), extension contact (**EXTCT**), family labour (**FAMLBR**), family size (**FAMSIZ**), land ownership (**LANDWN**), land size (**LANDSIZ**), *dimba* ownership (**DIMBWN**), *dimba* size (**DIMBSIZ**), livestock ownership (**LVSKWN**) and taboos (**TABS**). The details for the definition of the variables are given below:

SEXHD Sex of the household head was included in the model as a dummy variable with 1 for male and 0 for female to examine if sex of the household head had any influence in adoption of fish farming. It was expected that the majority of adopters of fish farming would be males perhaps because men mostly do digging of ponds while women do other tasks such as feeding. It was therefore hypothesized that sex would have positive relationship to the adoption of fish farming.

AGEHD Age of household head is continuous variable measured in years. It was included in the model because age may influence the adoption of new technologies. While young people may want to test technologies, old people may have resources, which can help them adopt fish farming. Age was therefore, hypothesized to be positively related to adoption of fish farming.

SSTAHD Socio-status of the household head was included in the model as a dummy variable with 1 for those people with status and 0 representing those without status. People with status are those who are influential, have access and control of resources such as land, livestock etc. It was thus hypothesized that adoption of fish farming was positively related to status of the household head.

EDCST Educational status was included as a dummy variable with 1, for those who attended some education and 0 for the ones that did not attend any education at all. Exposure of household head to some education was considered to have influence on understanding new technologies. Farmers with some education are able to process information and are open to new ideas. Educational status was therefore considered to have positive influence on adoption decisions.

EXTCT Extension contact recorded as a dummy variable with 1 if farmer has access to extension contact and 0 if the farmer has no extension contact. Uptake of new technologies is influenced by contact between extension staff and farmers due to information flow. It was hypothesized that extension contact is positively related to adoption of fish farming.

FAMLBR Family labour was recorded as a continuous variable. For example, members of the family may take care of ponds when the household head is away. It was hypothesized therefore that family labour has a positive relationship to adoption of fish farming.

FAMSIZ This was a continuous variable. Adoption of fish farming is expected to be positively related to family size. Farmers with large family are likely to adopt fish farming. They are expected to have enough labour compared to those with small family size.

DIMBWN *Dimba* ownership was recorded as a dummy with 1 for *dimba* ownership and 0 otherwise. Ponds can be constructed in *dimbas* where other farming activities such as vegetables and other crops are grown. It was hypothesized that people with *dimbas* are likely to adopt fish farming.

DIMBSIZ *Dimba* holding size was recorded in hectares. It was hypothesized to have an influence on the uptake of fish farming. The larger the *dimba* the higher the chances that one would adopt fish farming.

LANDWN Land ownership was recorded as a dummy variable with 1 for land owned by household, 0 otherwise. Farmers who own land are expected to invest in the improvement of their land as opposed to those who do not own it. Land was hypothesized to have a positive relation to adoption of fish farming.

LANDSIZ Land holding size was recorded in hectares. It included all land available to the household. Land size was hypothesized to have a positive relationship to adoption of fish farming.

LVSKWN Livestock ownership was recorded as a dummy with 1 representing that the household owned livestock and 0, otherwise. Farmers with livestock are more likely to adopt fish farming than those without because of the need for manure for fish ponds. Livestock ownership was therefore hypothesized to have a positive relationship to adoption of fish farming.

TABS Taboos was included in the model as a dummy with 1 representing respondents who are not affected by any taboos in eating fish from manured ponds and 0 for those who are affected by taboos for eating fish from manured ponds.

The parameters in the model were estimated using the following equation:

Model estimation

Since land ownership (LANDWN) and *dimba* ownership (DIMBWN) were constants, they were dropped from the model. Because of multicollin-

The parameters in the model were estimated using the following equation:

$$E(Yi) = \alpha + \beta_1 SEXHD + \beta_2 AGEHD + \beta_3 SSTAHD + \beta_4 EDCST + \beta_5 EXTCT \quad (1) + \beta_6 FAMLBR + \beta_7 LANDSIZ + \beta_8 DIMBSIZ + \beta_9 LVSKWN + \beta_{10} TABS + \varepsilon_i$$

Where Yi = dependent variable; α = constant; β^s = coefficients of each of the independent variables

ε_i = error term

earity, family size was also dropped from the model. The final model included sex, age, social-status, education status, extension contact, family labour, land size, *dimba* size, livestock ownership and taboos.

Results

The results of the logistic regression model are presented in Table 1. The parameter estimates suggest that age, sex, *dimba* size and livestock ownership are key variables affecting the adoption of fish farming. The model is appropriate because of two reasons. Firstly, its goodness of fit chi-square 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 models prediction of success of 69.60% is moderate meaning that the model correctly classified 69.6% of the farmers as either adopters or non-adopters of fish farming.

Table 1 Results of Logistic regression model used to predict factors affecting fish farming adoption in Mchinji RDP, Central Malawi, (December 2002 – February 2003).

Variable	Coefficient	S.E.	P. value
SEXHD	-1.4852	0.8266	0.0724**
AGEHD	0.0306	0.0176	0.0823**
SSTAHD	-0.3203	0.7450	0.6672
EDCST	0.9064	0.6036	0.1332
EXTCT	0.1922	0.4362	0.6594
FAMLBR	0.0348	0.1429	0.8074
LANDSIZ	0.1181	0.1313	0.3683
DIMBSIZ	0.6761	0.3598	0.0602**
LVSKWN	1.3389	0.6598	0.0424*
TABS	7.0424	20.7885	0.7348
Constant	-9.5599	20.8219	0.6461

-2 Log likelihood =144. 197

Goodness of fit =121.050

Prediction of success69.60%

* = significant at (P< 0.05)
**= significant at (P< 0.10)

Discussion

The analysis has shown that there is a negative relationship between the probability of adopting fish farming and sex of the household head. In conjunction with the theoretical expectations, the probability of women to take part in adoption of fish farming is lower. This implies that women are less likely to adopt fish farming than men. One possible explanation for this is probably the fact that men are the ones who mostly undertake the digging of ponds while women take part in other tasks. Women are generally involved in feeding and selling at harvest or processing (Williams, 1997; Engle *et al.,* 1997)

On the other hand, Arnon (1989) observed that most rural women are illiterate and this hinders them from having access to the required information while at the same time most extension messages focus on men neglecting women. The above are some of the likely reasons why less women adopt fish farming than men.

The model indicated a significant positive relationship between age of the household and probability of adoption of fish farming. In this study majority of farmers who adopted fish farming were in the age bracket 30-49 years. Thangata *et al.*(2003) conducted some studies in which they observed that relatively young households for example, of 30-49 years, are more risk takers relative to older households in the adoption of new technologies. On the other hand although older farmers may be less inclined to try newer farm practices, they have more access to land, income and other resources.

In Malawi, land holdings are small and the majority of smallholder farmers cultivate land holdings that are less than 1 ha. The decrease in land resources and the increase in human population has given way to cultivation of unsuitable and marginal areas such as *dambo* areas (Saka *et al.* 1994). *Dimbas* are cultivated in *dambo* areas where vegetables and other crops such as maize are grown after the rainy season. *Dimbas* are also possible sites where ponds can be constructed. Therefore, sizes of *dimbas* may have influence on the farmers' decision on whether or not to adopt fish farming. In this study, livestock ownership is also noted to affect 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 serve as source of manure for crops, vegetables and fishponds. Similar results were reported by Jamu *et al.* (2002).

The results of this study have significant implications for extension personnel and policy makers. Extension should target and develop practical fish farming training for economically active groups of ages between 30 and 49 years. In addition, women are in the forefront of food production so their participation in fish farming should be promoted. Results also suggest that the unsuitable sites for crop production in *dimba* areas may be developed for fish farming. Finally, livestock rearing may be a catalyst to adoption of fish farming.

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