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Realizing Farmer's Objective - Vital to Adoption Process of Fish Farming Technology. The Case of Selected Villages in Eastern Tanzania

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Abstract: This study was conducted to investigate how realizing farmer's objective has an influence on the adoption process of fish farming technology in Eastern Tanzania. A survey design was employed to collect data from 410 respondents randomly sampled from 25 villages. The study population comprised of non-adopters, continue-adopters and adopters-abandoned. Instruments used for data collection included questionnaire, Participatory Rural Appraisal, researchers' observations and secondary information sources. Descriptive statistics was used to report findings and data was validated by mean percentages. The results showed that farmers adopted fish farming in order to obtain fish for domestic consumption and for sale. However, while most women gave more priority to fish as food, more men gave priority to fish as a cash crop. Farmers who realized their objectives continued and intensified fish farming technology. Conversely, those who did not realize their objectives abandoned or practiced low level technology. Farmer's objectives were not realized due to poor production technology, harvest strategy and the nature of the product. Accordingly, non-adopters were reluctant to adopt fish farming because the technology did no have significant impact on the adopter's well-being. This finding suggests that farmer's objective and priority should be known before introduction of the technology and efforts should be directed towards realizing the objectives. Additionally, efforts should be made to improve production technology, preparation and preservation skills and harvest strategies. Finally, any analysis focusing on realizing farmer's objectives and priority should not be generalized but should be gender disaggregated.

Key words: Farmer's objective, fish farming adoption, food, income security

INTRODUCTION

Most farmers in rural Morogoro and parts of Dar es Salaam regions, Eastern Tanzania are unable to produce food and income to meet their household needs (ALCOM, 1994). The study also revealed that there is poor nutritional content of food produced. Most households' diet constituted of cereal crops (ibid.). Improving farm production through integrating modern technology into the existing farming system is essential for the enhancement of household food and income security (Wetengere, 2009). Fish farming is one of the technologies that were introduced to meet that end (Wetengere *et al*., 1998). Fish, when available, are generally cheaper than land animal meat and contain protein levels of 17-20% as well as minerals and vitamins (Hague, 1992). ALCOM reports revealed that fish farming supplies cheap and readily available fish for home consumption as well as for sale and increased production of crops like vegetables, bananas, yams and sugarcane (Wetengere *et al*., 1998). These crops were grown all the year-round as a result of benefiting directly from fertilized pond water and/or moisture (ibid.). In Malawi for instance, fish farming integrated into an existing agricultural system increased production, overall farm productivity and produced up to a six-fold improvement in profitability (Brummett and Noble, 1995).

Despite high potentials that fish farming possess, the adoption of the technology leaves much to be desired (Wetengere, 2008, 2009). The adoption rate measured as the percentage of farmers with suitable resources has been low (Balarin, 1985; Msuya, 1992; Wetengere *et al*., 1998). Similarly, the abandonment rate has been high (Wetengere, 2008). More than 25% of fish farmers in the study area abandoned the activity (ibid.). Researcher's observation revealed that several ponds were in bad shape (overgrown by grass, high water transparency, low water levels and collapsed dike) and were likely to be abandoned in the near future (ibid.). This finding is similar to that by Wijkstrom (1991) who noted that about 20% of fish farmers abandoned their ponds in Zambia. In addition, fish farming technology adopted has been characterized by a low level of technology adoption such as small size ponds likened to holes, poor quality seed, low input allocation in terms of cash income, labor time, feeds and fertilizers, and infrequent harvest (Wetengere, 2008). All these together have made the contribution of fish farming to adopter's well-being to be low.

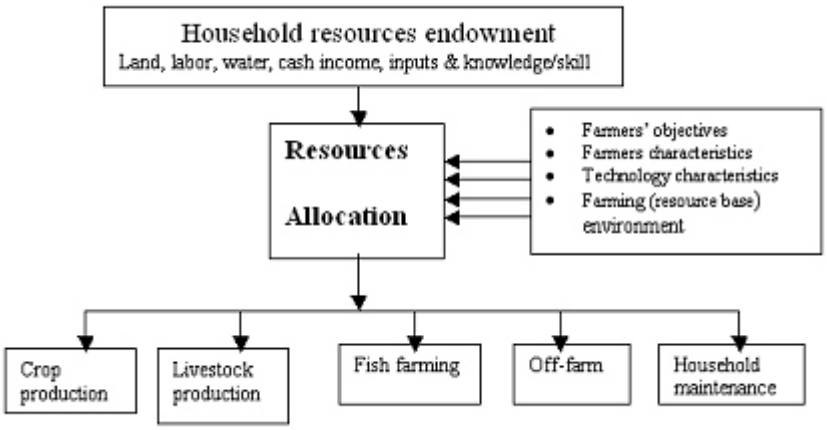

Fig. 1: Farmers decision to adopt, continue or intensify fish farming technology, Source: Wetengere (2008)

According to FAO (1996) the main objective for introducing fish farming in the study area was to: increase cash income and/or animal protein component in the diet of rural communities, achieved through small-scale aquaculture integrated with suitable farming system. Another objective was a pond being an efficient means of using surplus resources, thus increasing efficiency of farm activities (ibid.). Other objectives includes the construction of fish pond as a way to get usufruct over piece of land which was formerly a common property resource (van der Mheen-Sluijer, 1995), to gain status and prestige in a society (Peterson, 1982) and to get assistance in cash or kind (i.e. allowances and tools) from the project (Wetengere, 2000a). The objective of improving food and income is considered more decisive to the adoption process of fish farming technology.

While the rationale for adopting fish farming as stipulated above is clear, few if any researchers have attempted to assess how adopter's objectives have been realized. Most studies have concentrated on production technology giving a lesser priority to the extent to which the technology has attained farmer's objectives for undertaking it. Lack of balanced assessment of the two has contributed to poor understanding of why the adoption rate and level of intensification are low, and the abandonment rate is high. Few examples will suffice to justify this point. A pond may have a lot of fish which have not been harvested simply because there are no harvesting materials or a pond may have many stunted fish which are not the preference of consumers. It is also likely that a well-managed pond may be lying empty because fish have been predated or stolen. Thus, having a well-managed pond is one thing and its contribution to household food and income security is another thing.

Although the subject of technology adoption has been widely examined by a number of researchers (Polson and Spencer, 1991; Minde and Mbiha, 1993; Mattee, 1994; Mlozi, 1997; Senkondo *et al*., 1998; Batz *et al*., 1999; Kisusu, 2003), there are a few thorough studies that has been carried out to assess the adoption of fish farming technology in Tanzania (Wetengere, 2008, 2009). In addition, a review of these studies suggests that adequate attention has not been given to the study on how realizing farmer's objective has influence on the adoption process of fish farming technology. The objective of this paper therefore is to make a thorough investigation on how realizing farmer's objective has influenced the adoption, abandonment and intensification of fish farming technology in the study area.

Conceptual framework of adoption process: For the purpose of this study it is assumed that farmers make adoption decision based upon utility consideration (Batz *et al*., 1999). Comparing various activities that are carried out farmers will adopt an activity if its utility exceeds the utility of others. Utility of an activity is measured by its contribution to household food and income security. Household resources (i.e. land, labor, cash income, on-farm inputs and knowledge/skill) are allocated across various activities based on their contribution to household food and income security (Fig. 1). The allocation of resources is often characterized as a two-stage process in which the first priority is given to meet food security requirement (Temu, 1999). The second objective is then to maximize income using the remaining resources (ibid.).

When a technology is introduced in a given area, the decision whether to adopt, continue and intensify it or not will depend, among other things, on how a technology meets household objective of food and income security. Fish farming contributes to household needs through provision of fish for home consumption and cash income. However, fish farming is not the only activity, which meets the above objectives; there are other activities,

which compete with fish farming to meet those objectives. For instance, it competes with livestock production to meet animal protein intake and competes with crop production, livestock production and off-farm activities to earn cash income (Fig. 1). That means fish farming competes with those activities for resources to realize household objectives. The decision whether to adopt, continue or intensify fish farming technology or not will depend on how best and easy the technology will accomplish the intended objectives.

For the sake of this study, food security is defined as the condition of being protected from irregularity of food supply. Fish farming can contribute to offset food irregularities if fish can be obtained regularly. Due to land shortage and land degradation, most farmers in the study area face an increasing food deficit (van Donge, 1992) and irregularity. If fish farming will enable a more regular supply of food compared to other activities, it would be more preferred to other farming activities. Similarly, given the seasonality of rain, there is a period in a year when farmers' are facing food shortage. If farmed fish can be obtained at any time of the year and particularly when there is shortage of other sources of relish, fish farming is more likely to be adopted, continued and intensified than other farming technologies.

Income security can be defined as a condition of being protected from irregularity of income generation. Fish farming can contribute to offset income irregularities if farmed fish can be sold to generate income on regular basis. The contribution of fish farming is analyzed by assessing the size of income, number of times income is generated and a time period when income is earned relative to other competing activities. The size, frequency and timing of income generation not only determine the adoption and continuation but also the intensification level of the technology. Resource-poor farmers are more likely to adopt, continue and intensify a technology which generates bigger income, is capable of earning cash income regularly and timely during periods of shortage than others activities.

MATERIALS AND METHODS

This study was conducted in November 2005 - May 2006 in 25 selected villages of Morogoro and Dar es Salaam regions. The choice of these areas was purposive and based on the following reasons: First, a number of fish farming projects have been operating in these areas for many years. It is therefore assumed that the contribution of fish farming to household food and income security will be known. Secondly, low income and animal protein intake, both of which characterize particularly the Morogoro Region increases the need to adopt, continue and intensify fish farming. Furthermore, there is relatively limited published information on influence of realizing farmer's objectives on adoption process of fish farming technology.

Table 1: Total sample size used in the study area

	Morogoro	Dar es Salaam	Total
Fish adopters	217	17	234
Non-adopters	96	10	106
Adopters-abandoned	60	10	70
Total	373	37	410

Source: Survey Results, 2006

It is estimated that there are approximately 600 fish farmers in the study area from which 234 fish farmers were selected. Table 1 show that of the 410 respondents selected, 57% (234) were fish adopters (those who adopted and continued with fish farming), about 17% (70) adopters-abandoned (those who abandoned fish farming after adopting it) and 26% (106) non-adopters (those who have never adopted fish farming). Of the total sample size, 91% (373) respondents were from Morogoro region and the rest 9% (37) respondents were from Dar es Salaam. From each village a systematic random sampling approach was used to select the respondents. This sampling technique was used to avoid conscious or unconscious biases in the selection of sampled households. From each village additional names of between 2 and 5 were identified for replacement in case the respondent for one reason or another was not available.

The instruments used for data collection were a structured questionnaire, Participatory Rural Appraisal (PRA) and Researchers observation conducted in each village with a group of farmers. The questionnaire was prepared to solicit information on objectives for undertaking fish farming and assessed whether the objectives were realized or not. Further more, it assessed number of times farmed fish was consumed and period of the year it was consumed, and it also assessed the size of income generated, number of time it was generated and period of the year income was generated. In addition, secondary information was collected from various sources and was used to design questionnaires and explaining a big part of this study.

Data analysis was conducted with Statistical Package for Social Sciences (SPSSx) computer programmes. Mean percentage was produced to validate each research question. In PRA meeting, a question was discussed and a point was taken after a consensus among members had been reached. In case there was disagreement among members it was also reported.

RESULTS AND DISCUSSION

Demographic characteristics of the respondents: Table 2 presents the demographic characteristics of 410 respondents sampled from Morogoro and Dar es Salaam regions. The characteristics considered were those

Table 2: Demographic characteristics of the sample

Respondents characteristics		Sampled regions: Morogoro n = 373 (%)	Dar es Salaam n = 37 (%)	Total sample n = 410 (%)
Gender/sex	Male	76.1	75.7	76.1
	Female	23.9	24.3	23.9
Household head	Yes	78.8	81.1	79.0
	No	21.2	18.9	21.0
Main occupation	Full time farmer	47.7	18.9	44.1
	Farmer + business	49.9	37.8	48.8
	Farmer + employee	1.60	29.7	4.10
	Others	0.80	13.5	2.0
Education level	No formal education	14.7	10.8	14.4
	Less than Standard 7	16.1	5.40	15.1
	Standard 7	64.3	37.8	62.0
	Secondary + post secondary	4.80	43.2	8.30
	Others	0.00	2.70	0.20
Age	Average years	42.2	46.7	42.6
	≤ 30 years	22.0	5.40	20.5
	31 – 50 years	55.0	56.8	55.1
	51 ≥ years	23.1	37.8	24.4

Source: Survey results (2006)

Table 3: The objectives for undertaking fish farming

Objectives for adopting fish farming	Male (in %) n = 239	Female (in %) n = 65	Total (in %) n = 304
Fish for home consumption	100	100	100
Fish to generate income	97	96	97
Imitated relative/friends/neighbors	13	5	11
Advised by the project	6	3	5
Gain status	4	0	3
Others	3	0	3

Source: Survey results (2006)

postulated to have influence on adoption of fish farming technology. Male respondents comprised of 76.1% with more or less equal proportions in the two regions. About 79% of respondents were household head a fact, which ensured that detailed household information searched for, was obtained easily. Seventy two percent of all household heads were male and only 7% were female.

As expected, 99.3% of households do farming as one of their livelihood earning activities. However, 55% of respondents indicated that farming was not the only household main activity in the study area. About 49% of the respondents derived their livelihood from farming and business, 4.1% derived livelihood through farming and employment and others [farming and business, student and employment only] (2%). While 47.7% of full time farmers and, 49.9% of farmer and business came from Morogoro, 29.7% of farmer and employee and 13.5% of others (farmer and business, and employee only) came from Dar es Salaam. The percentage of full time farmers is relatively lower than the national average of 63% (TNBS, 2002). This is likely due to lack of permanent cash crops along Uluguru Mountains. As a result farmers engage in other income earning businesses to supplement income. The main type of business carried out particularly in Morogoro region is local brew making. Other businesses include; small shops, selling of timber, charcoal, bricks and crops.

Sixty two percent of respondents had attained primary education, about 15.1% had less than standard seven education, 14.4% had not undertaken any formal education and 8.3% had attained secondary and post secondary education. The percentage of those who had no formal education (11.8%) is relatively lower than the nation average (33.0%). This is likely because most parts of Morogoro highlands were centers of Missionaries who had put emphasis on formal education. While majority of those who had attained standard seven and below came from Morogoro, majority of those who attained secondary and post secondary education came from Dar es Salaam (Table 2).

About 55% of respondents were within the age category of 31 - 50 years followed by 24% of respondents with 51 years and above and 21% of respondents with 30 years and below.

Farmer's objectives for undertaking fish farming: Table 3 shows that all respondents adopted fish farming in order to obtain fish for home consumption and most did so to generate cash income. This result is similar to those by FAO (1996), Edwards *et al.* (1997), Wetengere *et al.* (1998) and Wetengere (2000b). This is consistent with finding by Temu (1999), which indicated that household resource allocation is often characterized as a 2 - stage process in which first priority is given to meet food

Table 4: Relative importance of objectives for undertaking fish farming

Objectives	Ranking	Male (in %) n=239	Female (in %) n=65	Total (in %) n=304
Fish for home consumption	1	66	83	70
	2	32	17	29
	3 & 4	2	0	2
Generate cash income	1	30	9	26
	2	64	86	69
	3 & 4	5	5	5

*: An objective ranked 1 is considered more important than objectives ranked 2 or above; Source: Survey results (2006)

security requirement. The second objective is then to maximize income using the remaining resources. The need to ensure household food security is based on uncertain food market (due to escalating food prices and unavailability) and unpredictable environment conditions (ibid.). Participants in a Participatory Rural Appraisal (PRA) conducted in this study were of the opinion that although most farmers adopted fish farming technology for both food and cash generation; it was the former objective which was more pressing and important in the study area.

This finding also shows that there were no significance differences in terms of percentage of males and females farmers adopting fish farming for the above purposes. Other objectives for undertaking fish farming were considered to be minor as only a meager percentage (below 11%) of respondents mentioned them. Gender wise, more males than females adopted fish farming because of imitation from relatives, friends and neighbour and because they were advised by the projects. Participants in a PRA meeting indicated that that was perhaps because most females do not have time to visit other farmers for learning purposes and also because most projects do not have conscious efforts to contact females farmers. Similarly, while there were few males who adopted fish farming to gain status and others, none of the females did so for those purposes.

Relative importance of objectives for adopting fish farming technology: Table 4 show that the adoption of fish farming for home consumption was ranked first by 70% respondents, ranked second by 29% and the rest by 2%. On the other hand, only 26% of the respondents ranked income generation first, about 69% ranked it second and the rest (5%) ranked it third and fourth. The importance small-scale farmers attach to household food security shows that food production is a number one priority. This is consistent with Engle (1985) findings, which indicate that one of the pressing issues facing small-scale farmers is how to ensure adequate supply of food to the family, either through producing food or purchasing it. The need to ensure household food security is based on uncertain food market (due to escalating food prices and unavailability) and unpredictable environment conditions (Temu, 1999).

Gender wise, this result show that while 83% of women ranked the adoption of fish farming for home consumption first, 66% of male ranked it first. Conversely, while 30% of male ranked the adoption of fish farming for generating cash income first, very few females ranked it first. This should not come as a surprise as fish farming was mainly undertaken to produce fish for home consumption - an objective which suit female than male (Wetengere, 2008). Women were responsible for fetching relish for the household which was inadequate particularly in the Uluguru Mountains where animal protein was in short supply (ibid.).

Realizing farmer's objectives: Having known the objectives for undertaking fish farming, an attempt was made to establish whether the farmer's objectives were realized or not. Realizing farmers objective is thought to be one of the strong motivations for non-adopter to adopt and adopters to continue and/or intensify the activity. Farmers were asked to explain whether the objectives for undertaking fish farming were realized or not. This study found that only 16% (49) of the 304 respondents (continue-adopters and adopters-abandoned) realized their objectives. Of the fish farmers (16%) who realized their objective for undertaking fish farming, 66% were male and 34% were female.

Participants in a PRA meeting indicated that during introduction of the technology in the study area the project officers told them that fish farming was capable of providing fish for home consumption and cash income generation on regular basis and at a time when other sources of relish were in short supply.

Realization of the objective of fish for home consumption : An advantage of fishpond is that farmed fish can be consumed frequently and at time period when there is shortage of animal relish. This study however showed that fish farming was ranked third in terms of the total number of respondents who consumed the relish in the study area (Wetengere, 2008). Dried fish popularly known, as *dagaa* was the relish, which was consumed by most farmers and was followed by chicken. Of the eight relishes, which were consumed in the study area, farmed fish ranked sixth in terms of frequency in consumption. Relishes, which were consumed more frequent, include

dagaa, chicken meat, eggs, pork meat and beef meat. Participants in a PRA meeting indicated that relishes, which were consumed more frequently, were those produced locally and easily obtainable. Similarly, the result showed that consumption of farmed fish surprisingly followed a seasonal trend similar to other relishes. The same trend was also shown by fish adopters when separated from the rest of the sample.

Realization of the objective of generating cash income: Another postulated advantage of farmed fish as a cash crop over other cash crops is that it is a source of cash income to majority farmers and income from it can be earned on regular basis. This study showed that cash income from fish farming contributed only 2% of the total income earned in the study area (Wetengere, 2008). Similarly, fish farming was ranked fifth in terms of the total number of respondents who earned income from selling farmed fish in the study area (ibid.). Most farmers earned cash income from seasonal crops and business. Other sources of income include permanent crops and animal husbandry. Of the seven cash income earning activities in the study area, fish farming ranked sixth in terms of frequency in income generation. Activities, which generated cash income more frequent, include business, permanent crops (i.e. sale of banana), seasonal crops, and animal husband. Although fish farming had potential to generate income at any time of the year and therefore could fill the gap of income shortage, its income generation surprisingly more-or-less followed a seasonal trend of other income generating activities.

Reasons why the objectives for adopting fish farming were not realized: The above information has revealed that the objectives for undertaking fish farming was to a large extent not realized in comparison with other competing activities. This was attributed to poor production technology, harvest strategy and nature of the product (i.e. farmed fish) as hereby explained.

Production technology: Participants in a PRA meeting revealed that the consumption and income generated from fish farming depended, among other things, on production, which was smaller compared to other activities. This was due to a number of factors, including small sizes of fish ponds which was attributed to unknown income or profit from fish farming, unavailability or high opportunity cost of land suitable for pond construction, inadequate family labor to construct big ponds, lack of cash to hire labor, difficulty of constructing bigger ponds on steep terrain, lack of knowledge on the minimum pond size requirement and unavailability or high opportunity cost of inputs needed to feed and fertilize fish pond - as a result very little was invested. Other factors include, losing fish through animal predation, human theft, drought, floods (which washed away the ponds), purposely or accidentally poisoning fish ponds through spraying vegetables or coffee trees, and spoiling of harvested fish due to poor knowledge of preservation.

Another reason for low consumption and income earned was due to poor market for farmed fish. Most fish were sold within the villages where customers were few, had low income, and were unfamiliar with eating farmed fish. Furthermore, customers preferred fried fish, which increased cost of vendors, and there was high competition from other sources of cheap animal protein. Customers in small nearby towns preferred bigger fish which were not readily available, and if available were difficult to transport due to poor roads and preservation methods. Poor management of group owned ponds also contributed to low production.

Harvest strategy: The ability to earn cash income and eat fish regularly is not only related to production but also to the harvest strategy being practiced. Participants in a PRA meeting indicated that harvesting fish was done irregularly due to the following reasons; first, lack of well defined harvesting strategy. Some projects advocated for net harvest while nets were unavailable or inadequate. In some villages one net served two villages, which means a farmer had to wait for 1-2 weeks to get a net. In other words, farmers were not assured of getting fish when they wanted. In some ponds the presence of weir (This is a structure made of sticks or small poles constructed in the pond to divide the pond into 2-4 halves. The spacing of the sticks allows fish to swim through one halve to another but the spacing is too small for an otter to pass. In this way it prevents otters from eating fish.) was incompatible with net harvest. In other villages the motivators prohibited farmers from harvesting fish unless they were present to collect harvest data. In other villages farmers had to pay for fishnets, which was amounted to buying their own fish.

Other projects advocated for harvest by total drainage of the pond, a method, which was not accepted by most farmers due to lack of knowledge on how to do it; in some places total drainage was impossible due to flatness of land, fear of killing fry or eggs, water shortage or wastage of fertilized water, lack of storage pond and lack of labor time. Sometimes even when these obstacles did not exist, farmers were reluctant to harvest because fish had not bred or had not grown to a size preferred due to poor management, and many ponds were too small and/or were located far from homestead and thus, did not favor frequent harvest. Other reasons included misunderstandings among group members - some felt fish were ready for harvest, others thought otherwise, which also lead to unnecessary delayed harvest.

Nature of the product (i.e. Farmed Fish): Participants in PRA meetings described farmed fish as relish rather than a food. As a result farmed fish was assigned a secondary priority to other types of food. From farmers' view, a relish is something that is only used with something else and is generally not eaten all by itself, while food is in itself a main dish. Maize, cassava, rice wheat or sweat potatoes were considered food as they can be eaten all by themselves and therefore cater for food shortage or hunger, farmed fish on the other hand could not. In allocation of resources, farmers gave priority to food crops first.

Other crops like beans and vegetables such as cabbages are relish but had advantages that they earned a considerable amount of income and were not quickly perishable and therefore could be sold in distant bigger and assured markets. Conversely, farmed fish were very perishable and could not be easily marketed in distant markets.

Realizing farmers objectives and how is related to adoption process of fish farming technology: An attempt was also made to establish relations between objective attainments versus adoption rates, abandon rates and intensification of fish farming. Table 5 shows that 16% of respondents (adopters and adopters-abandoned) realized their objectives for undertaking fish farming. Of those who realized their objective, majority were adopters (20%) compared to only 4% of abandoned-adopters. The result further shows that of the 16% (49), who realized their objectives, 94% (46) are continue-adopters and only 6% (3) are adopters-abandoned. On the other hand of the 70 adopters-abandoned, majority (96%) did not realize their objectives (Table 5) – one of the facts that justified abandonment of fish farming in the study area.

Similarly, of the 234 continue-adopters majority (80%) did not realize their objectives a fact, which made fish farming to be continued at a low level. Participants in PRA meetings mentioned that the present "laissez faire" or let alone sort of management characterizing fish farming industry in the study area is a result of fish farming failing to realize the intended objectives. Participants in PRA meetings further indicated that it was common for the farmer's to continue with an activity even when objectives for adopting it were not fully realized. This is consistent with Brummett and Noble (1995) who noted that many farm enterprises were carried out from year to year despite continually loosing or earning negligible amount of money. In contrast, most of those who realized their objectives continued and intensified fish farming. ALCOM progress reports show that farmers who intensified fish farming harvested up to 40-60 kg/are/y. According to Wetengere *et al.* (1998) this output was more profitable than other types of crop production.It was profitable even when the crops are rotated three times a year (ibid).

Table 5: Realization of objectives for adopting fish farming

Responses	Adopters (%) n = 234	Adopters-abandoned (%) n = 70	Total (%) N = 304
Yes	20	4	16
No	80	96	84

Source: Survey Results, 2006

Participants in PRA meetings conducted among non-adopters mentioned that one of the reasons why they have not adopted fish farming technology is because the technology has hardly done anything on the well being of the adopters. They mentioned for instance, that the adopters of fish farming were facing relish and income shortage just as the non-adopters were facing. For that matter there was no reason to adopt the technology. Some of the non-adopters mentioned that they attended introduction meetings of fish farming and were impressed and convinced that fish farming would change their life. However, after seeing what the technology has done to the early adopters, they have changed their mind. Some non-adopters indicated also that fish farming technology was not their need and priority but was imposed by project leaders. This result is similar to earlier findings by Van der Mheen-Sluijer and van der Mheen (1988), which indicated that the topic of fish farming was always introduced by the project. This means that the initial idea never originated from the people themselves (ibid.).

CONCLUSION

The objective of this study was to make a thorough investigation on how realizing farmer's objective has influence on the adoption process of fish farming technology in the study area. The results have shown that most farmers adopted fish farming to obtain fish for home consumption as well as for sale. However, while most females ranked the adoption of fish farming technology to obtain fish for home consumption first, most males ranked generation of cash income first. The result further showed that few farmers realized their objectives for adopting fish farming. Consequently, most adopters operated fish farming at low level, others abandoned the activity and non-adopters were reluctant to adopt the technology. Farmer's objectives were not realized due to poor production technology, harvest strategy and nature of the product (i.e. farmed fish). Moreover, farmers who realized their objective intensified the activity and were able to produce up to 40-60kg/are/y - a production that was considered more profitable than other crop production.

RECOMMENDATIONS

This study has spurred some interesting and important recommendations. The first is that although most farmers adopted fish farming technology for food as well as for income generation, most females gave more

priority to fish as food while males gave more priority to fish as cash income generation. This implies that technology developers and extension officers should incorporate gender dimension when assessing how farmers objectives were realized. The second is that realizing farmers objective has influence on adoption of the technology. This suggests that farmer's objective for undertaking a technology and their priority should be known and taken on board before introducing the technology, and efforts should be made to realize those objectives. For this reason preparation and introduction stages of any technology should involve the farmers. The third is that, for fish farming to realize farmers objectives, the production technology, harvesting strategy and storage technology need to improve. Production technology will ensure that more fish is produced and a farmer friendly harvest strategy will ensure that farmed fish is readily available. Accordingly, improved storage facilities will ensure that farmed fish are properly preserved and can be transported to distant market to make more profit.

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