

FACTORS DETERMINING THE REJECTION OF FISH FARMING INNOVATIONS
IN A RURAL ZAMBIAN COMMUNITY

A Thesis

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

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December 2015

Major Subject: Agricultural Leadership, Education, and Communications

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ABSTRACT

The objective of this qualitative study was to address the rejection of fish farming innovations in the rural farming community of Munendwe Village, Eastern Province, Zambia. The researcher, also the resident Peace Corps Volunteer, experienced challenges facilitating the adoption of innovations in fish farming throughout the assigned 24 months of service in this community. The purpose of this study was to identify the influences related to gender, culture, time, and logistics for active fish farmers.

The sample was a census of 30 ($N=30$) fish farmers. This study utilized 30 unstructured, individual face-to-face interviews. The study sample consisted of nine ($N=9$) females and 21 ($N=21$) males. The theoretical framework of this research was based on Rogers' diffusion of innovations theory. It was pertinent that the population be interviewed about their attitudes toward fish farming innovations to aid in the understanding of what was affecting the rate of rejection in this community.

The findings of objective one indicate lack of labor, financial resources, access to fingerlings, and increased predation as the primary barriers affecting rejection in female participants. In male participants, primary barriers included a lack of resources in regard to harvesting, fingerlings, and finances. Future Peace Corps Volunteers are tasked with encouraging a resurgence of interest in labor sharing techniques common in agricultural cooperatives. Trainings and demonstrations of fencing strategies, to protect ponds from predators, are essential to the future success of fish farming practices. To address the lack of fingerling resources, Peace Corps Volunteers can work with community

members to introduce alternative methods of fingerling production such as brooding ponds. Government and extension agents from the Department of Fisheries are encouraged to establish savings programs or micro-loan agendas for small-scale farmers to support the launch of fish farming enterprises.

Access to this study is beneficial for Peace Corps Zambia staff members, particularly those designing Pre-Service Training in the Rural Aquaculture Promotion program, as well as current Peace Corps Volunteers. An understanding of what contributes to rejection in fish farming increases volunteers' capacity to work more efficiently and effectively in the given 24 months of service at their community post.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Strong, and my committee members, Dr. Muphrey, and Dr. Dooley for their support throughout the course of this research. I discovered conducting research and writing a thesis while living in Zambia was a very difficult, and often arduous task. I am eternally grateful for the guidance and encouragement I received from the three of you.

Thanks also go to my fellow Peace Corps Volunteers, Peace Corps Zambia staff and Rural Aquaculture Promotion program technical trainers. To Ba Cleophur, Ba Fraser, and Ba Donald, your collective, unending support and fisheries science expertise were crucial to the success and completion of my two years in the Peace Corps. I also want to extend my gratitude to the hospitable and charitable people of Mundendwe Village. I am forever in debt to the kindness and acceptance you all showed me in the two years I lived in your village.

Finally, and most importantly, thank you to my mother, father, and sister for their unwavering support and reassurance. Without your encouragement, I would have never had the courage to follow my dreams.

NOMENCLATURE

| | |
|-----|-----------------------------|
| DOF | Department of Fisheries |
| FRA | Federal Reserve Agency |
| PCV | Peace Corps Volunteer |
| RAP | Rural Aquaculture Promotion |
| ZMK | Zambian Kwacha |

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CHAPTER I

INTRODUCTION

Originally colonized as Northern Rhodesia by the British in the early 1800's, Zambia gained peaceful independence as the Republic of Zambia in 1964 (CIA, 2015). The population is approximately 15 million people including 73 ethnic groups among the indigenous population, and 75% of the population identifies as Protestant (CIA, 2015). Zambia is located in the southern region of Africa, and shares borders with seven adjacent countries, including Zimbabwe, Malawi, Mozambique, Tanzania, the Democratic Republic of the Congo, Botswana, and Namibia. English is the official language of government, but there are seven official languages in total (CIA, 2015). Major industries include copper mining, construction, wholesale and retail trade, tourism, manufacturing, and agriculture. Major trading partners include South Africa, the European Union, Japan, and China. Zambia is comprised of nine individual provinces, Lusaka, Central, Eastern, Southern, Western, Northern, Northwestern, Luapula, and the Copperbelt.

The farming and exporting of commodities such as maize, cotton, groundnuts, and sunflower contribute in large part to the nation's economy. "The agricultural sector continues to be the backbone for the Zambian economy as it contributes to the growth of the economy and also to exports. Primary agriculture contributes about 35 percent to the country's total nontraditional exports..." (Zambia Development Agency, 2011, p. 3). In rural communities, farmers rely heavily on the subsistence farming of their fields and

gardens to supplement the income generated from selling maize to the government's Food Reserve Agency (FRA).

The first reported case of HIV occurred in 1984. Since that date, HIV has become prevalent in every region of the country. The United Nations General Assembly Special Session Report (2012) estimates 1,327,995 people to be living with HIV. Infection rates are high among the wealthy and the underprivileged. The HIV seroprevalence is significantly higher among women (18%) than that of men (13%) and much higher among the urban population (25-35%) than the rural population (8-16%). The epidemic is estimated to have left at least 600,000 children orphaned (World Health Organization, 2005, pg. 1).

Impact of HIV on Women

The consequence of HIV/AIDS has affected women in a disproportionate manner, as women of the household must take on more time and labor for ensuring food security. "Care of the terminally ill, especially those with HIV and AIDS, has been relegated to home based care programmes, which in turn rely heavily on women to provide nursing care" (Mulikita & Siame, 2005, p. 5). According to a profile of women in Zambia entitled "Beyond Inequalities" published in 2005, there is a higher prevalence rate of AIDS among women in all age groups. This is due to social, cultural, and economic factors that can cause women to be more vulnerable to HIV and AIDS. Women are affected not only as HIV victims, but also as caregivers within the household. The practice of tradition and customary law leave women more susceptible to contracting HIV. When women are bound in marriage, it is not culturally acceptable to

deny sexual advances from their partner, nor is it acceptable to negotiate the use of condoms. “The current HIV and AIDS infection rate in Zambia stands at 16%, according to UNAIDS. Most of the infected in the 15-49 age group are women and girls. Some...are concluding that AIDS in Zambia, like poverty, has a ‘woman’s face’” (Mulikita & Siame, 2005, p. 7).

Peace Corps

The United States Peace Corps began as an international aid initiative headed by President John F. Kennedy in 1961. In an Executive Order, number 10924, released by The White House on March 1st of 1961, it was stated, “The Peace Corps shall be responsible for the training and service abroad of men and women of the United States in new programs of assistance to nations and areas of the world, and in conjunction with or in support of existing economic assistance of the United States and of the United Nations...” (“Teaching with documents”, 2014, para. 6). President John F. Kennedy stated that if young Americans were to offer their assistance and skills abroad, the hosting country would benefit from the fruits of their labors, and the United States would benefit from the goodwill of these actions.

Peace Corps Volunteers (PCV) assigned into the agricultural sector make up 5% of the total work area in all the countries that Peace Corps deploys volunteers. Education and health are the two largest sectors, with 38% and 24% deployed in these work areas, respectively (Peace Corps fact sheet, 2014). Those who volunteer in the agricultural sector participate in projects involving animal husbandry, applied agricultural science,

farm management and agribusiness, and agriculture/forestry extension (“Peace Corps agriculture”, 2011).

The three primary goals of Peace Corps include:

1. “To help the people of interested countries in meeting their need for trained men and women.
2. To help promote a better understanding of Americans on the part of the peoples served.
3. To help promote a better understanding of other peoples on the part of Americans” (Peace Corps fact sheet, 2014, para. 2).

Rural Aquaculture Promotion Program

In 1994, the United States Peace Corps began its operations in Zambia. The first volunteers were trained in water sanitation and hygiene education. In 1996, the program expanded to include the Rural Aquaculture Promotion program (RAP). The RAP program was established as a partnership between Zambia’s Department of Fisheries (DOF) and the Peace Corps, to provide trained persons capable of implementing modern innovations in fish farming to members of rural communities in eight of the country’s nine provinces. It was stated in a 2003 report from the Food and Agriculture Organization of the United Nations that, “...fish production is important in Zambia for employment, earnings, and as a source of food. Zambia has the potential for further development of aquaculture” (para. 1).

In 2004, the Peace Corps celebrated its 10th anniversary of project involvement in Zambia. As of 2015, Peace Corps Zambia boasts programs supporting rural

aquaculture promotion, rural education development (RED), linking income, food, and the environment (LIFE), and the community health improvement project (CHIP) (“A Peace Corps”, 2012). Peace Corps Volunteers assigned to Zambia live and work in eight of the country’s nine provinces. “Since the first Peace Corps Volunteers arrived in 1994, approximately 1,280 Volunteers have served in Zambia...” (“A Peace Corps”, 2012, p. 2). These projects equate to the largest Peace Corps program in Africa.

Peace Corps Volunteer Lifestyle

Peace Corps Volunteers assigned to Zambia live a rural lifestyle similar to those of the people in which they serve. The definition of rural is often described as a relative lack of infrastructure and access to amenities (Ibanez-Gonzalez & Tollman, 2015). Volunteers live in homes built from mud bricks and thatched grasses, and are placed within the confines of an established village. These homes do not include running water or electricity, and are located predominantly in rural areas. Amenities such as electricity and running water are typically more than ten kilometers in distance from a PCV’s home. Volunteers in Zambia are allocated a stipend each month for the purpose of purchasing food, household goods, transportation, and other miscellaneous necessities. The community which has requested to host the PCV has signed an agreement, stating the community is responsible for the upkeep and maintenance of the house the volunteer lives in. This is typically considered the in-kind contribution the village provides to receive the benefits of a partnership with the Peace Corps and with a PCV. Peace Corps Zambia Volunteers are outfitted with bicycles, water filters, and a solar lantern as their supplies for village survival. RAP Volunteers are tasked with encouraging and

facilitating the development of fish farming groups in their community. The existence of a designated group of people with whom to work is not a requirement of a village to receive a Peace Corps Volunteer.

Fish Farming Program in Munendwe Village

Beginning in May of 2013, farmers of maize, groundnuts and cotton, in the rural village of Munendwe, Sinda District, Zambia, were given the opportunity to participate in the Rural Aquaculture Promotion program facilitated by a PCV and under the United States Peace Corps. A Peace Corps Volunteer, who is also the researcher in this study, was placed in this community to facilitate for the RAP program for the duration of 24 months. The approximate population of Munendwe Village is 1,000 people. This is a considerably large village situated in the middle of two smaller villages, Chimbisu and Chinsamba, which both average about 500-600 people. Munendwe Village has a local community school. The two adjacent villages do not have educational facilities. Students from these smaller villages travel daily to attend school in Munendwe. In November of 2014, the construction of a village health post was proposed to meet the needs of the large and growing community. Construction on the structures began in early 2015, but the project is currently on hold due to further approval from local district officials.

The RAP program is a joint initiative between the Peace Corps and the Zambian Department of Fisheries, under the Ministry of Agriculture and Livestock. “RAP extension agents provide the missing link between district-based aquaculture agents and rural farmers. Volunteers work directly with farmers, helping them improve their own production, and training farmers to serve as farmer leaders and resource people for

future fish farmers” (“A guide to”, 2011, p. 17). Peace Corps Zambia volunteers promote an average sized pond of 10 meters by 15 meters with sloped inner walls, and compacted dike walls. The depth of these ponds is approximately 1 meter. These ponds are typically located in farmers’ gardens, separate from the fields in which they grow maize and other staple crops. These ponds are stocked with a mixture of fingerling breeds that come from several different species. The most common of these include Tilapia, specifically red-breasted bream, and banded bream. Another common species is the Oreochromis, specifically large-mouth bream. In most cases, the fingerling stock is available for purchase from government ponds managed by the Department of Fisheries. In 2014, this community’s district Department of Fisheries office participated in a program in which first time male fish farmers received a 50% discount on their fingerling order. The price at that time was 50 ngwee ZMK, which is equivalent to approximately \$0.08 in U.S. dollars. The same program allowed for first time female farmers to receive a 100% discount on their fingerling order. In the 2015 fish-farming season, the program was discontinued and all farmers regardless of their gender paid 50 ngwee for each fish in their fingerling order. An average order consists of 150 fingerlings, costing 75 ZMK, equivalent to \$12.50 in U.S. dollars.

The project’s six main objectives include, “...increasing quantity and quality of fish ponds, improving pond management, integrating aquaculture with other farming systems, increasing incomes from aquaculture, organizing fish farming groups, and establishing sustainable local fish seed production centers” (Bweupe, 2014, para. 2). At the end of every quarter of the two-year service, Peace Corps Volunteers are tasked with

submitting a Volunteer Reporting Form (VRF) to their Associate Program Country Director (APCD). This VRF includes indicators and reporting mechanisms for the four project sectors in Peace Corps Zambia.

The number of farmers in Munendwe Village that participated in fish farming in 2014 included 20 men and eight women. At the onset of the RAP program, it was recorded few of the farmers had previously belonged to a fish-farming cooperative in 2001, and the members of the cooperative had not been active in 13 years. Khumalo defined a cooperative as an, "...autonomous association of persons united voluntarily to meet their common economic needs and aspirations through a jointly owned and democratically controlled enterprise" (2014, p. 62). Many of those who participated in stocking and harvesting procedures in 2014 were first time fish farmers. In 2015, the number of farmers involved in fish farming in Munendwe increased to 30, with the ratio at nine women and 21 men. The total amount of fingerlings ordered, purchased, and stocked in 2015 was 3,610. This amount stocks on average, 28 ponds that measure 10 meters by 15 meters.

Food Security

In a study of food security challenges faced in India, Ramachandran (2013) cited the interpretation of food security as defined by the 1996 World Food Summit, "...a situation in which 'all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'" (p. 374). Various causes of food insecurity are found throughout countries deemed as developing, as well as countries considered developed. During a speech at a World Food

Prize Lecture, food security advisor David Lambert highlighted demand pressures such as increased global population, and the heightened desire for animal protein as causes of food insecurity (Lambert, 2014). Sen (1983), while defining food security in regard to famine and poverty, emphasized the difference between the availability of food, and the accessibility of food. Availability represents the situation in which the food is produced, but is considered inaccessible due to lack of income, or other unforeseen expenses.

The challenge of reaching a state of being food secure is one of the most formidable in the development of sub-Saharan Africa. In a study of determinants of food insecurity in sub-Saharan Africa, Sassi (2015) expressed the difficulty of being food secure is a result of many factors, two of which include the ever-expanding population rate, and the HIV/AIDS crisis. "...General consensus has emerged that food insecurity results from regional crises. In Africa—and in sub-Saharan Africa, in particular—food insecurity remains a chief development concern" (Sassi, 2015, p. 92). HIV has a pronounced negative effect on the challenge of increasing food security for people living in sub-Saharan Africa (Himmelgreen et al., 2009). Mwachabe (2014) stated in a study of food security and the African agrarian ideology, farmers in sub-Saharan Africa are "mentally wired to subsistence farming" as their traditions and customary values have dictated for generations (p. 413). Mwachabe hypothesized this perpetuated a cycle of short-lived crop harvests and continued famine (2014). An adherence to tradition influences modern-day farmers to shy away from modern-day technologies and innovations.

Food security in Zambia, and particularly in the rural-most regions, relies heavily on climate expectations and rainfall received throughout the year (Simatele & Simatele, 2015). In Zambia's Southern Province, 42% of the rural population lives with chronic food insecurity (Sitko, 2006). In Zambia, food insecurity is a cyclical process. Shortages of food occur during the peak of the farming season, thus causing many to neglect farming duties simply to be able to meet their nutritional intake for the day (Sitko, 2006). Another challenge facing food security in Zambia is the limited access farmers have to food export markets (Brenton, 2011). In a study seeking to contest strategies for confronting food insecurity in Zambia, Brenton (2011) found, "Zambia's Food Reserve Agency has a limited capacity to purchase their surplus...despite the surplus levels of maize...child malnutrition is still high in rural areas" (p. 190).

Gender

In a study of women, gender inequality, and participatory development, Mayoux described common findings in the published writings of development agencies. Mayoux stated that, "It is argued in the promotional literature of many development agencies that projects are unlikely to succeed without the full and equal involvement of women" (1995, p. 235). The United States Peace Corps is no exception. Beginning with Pre-Service Training (PST) and continued throughout service, Peace Corps Volunteers are encouraged to recognize the value of projects and programs that seek to facilitate the empowerment of women. This topic has been researched widely, particularly in regard to women living on the African continent. Subjects of these gender studies include economical worth and profit of investing in women, the effect of gender inequality in

development, and the humanitarian perspective of equal rights. “In different ways, unequal gender relations affect the social and economic status of all women, their access to resources, their control over their bodies and livelihoods, and their ability to make choices to live to their full human potential” (Albertyn, 2011, p. 140).

There is a value in studying women in agriculture. In patriarchal societies where home and childcare are left up to the females of the household, a lack of control over food and sustenance has implications for the nutrition of the entire family. In a study of gender-specific constraints and how they affected household food security, Mikalitsa stated, “The problems that face women farmers are more distinct due to socio-cultural constraints that affect their access to and control over essential assets...lack of access and ownership of productive assets is an effect as well as a cause of poverty” (2010, p. 2325).

Additionally, in a study of gender inequality in agriculture, Villareal found, “...inequalities hinder the achievement of development goals...across all areas of development, are particularly pronounced in rural areas. Women in rural areas continue to lag behind both rural men, and urban men and women” (2013, p. 169). Women in agriculture, who grow and provide food for their family unit, are hindered by unequal access to land, agricultural inputs, and time, and this is particularly prominent in rural areas.

Researchers have found the inequality of women in Zambia to be associated with poverty. Kapungwe’s study of gender and poverty in Zambia found that, “Numerous studies have demonstrated a strong relationship between poverty and the gender of the

head of the household, with female-headed households being more vulnerable than male...extreme poverty was disproportionately higher among female-headed households” (2004, p. 488). At the time of this study, there was a distinguishable lack of previous research in regard to Zambian women in agriculture. This is another stimulus for including gender as an objective in this study of rejection of fish farming innovations in a rural community in Zambia.

Gender polarization was defined by Bem as, “...culturally-constructed connections that currently exist in our society between what sex a person is and virtually every other aspect of human experience, including modes of dress, social roles, and even ways of expressing emotion” (1995, p. 329). The role gender plays in defining which activities women and men participate in throughout rural Zambia is prodigious. Ellis stated, “Gender is an integral and inseparable part of rural livelihoods. Men and women have different assets, access to resources, and opportunities...diversification can improve household livelihood security, while at the same time trapping women in customary roles” (1999, p. 4).

An objective of this research includes describing influences affecting women’s rejection of fish farming innovations. Additionally, Acharya and Bennett stated in their research of economic participation of women in the subsistence sector of Nepal, “Integrating women in the market economy is not only an efficient use of local resources, but also improves women’s status and economic security” (1983, para. 1). Fish farming was introduced as a lucrative and innovative solution to nutrition

deprivation and poverty. The effect gender had on the rejection of this innovation was an objective of this research.

Labor

Lack of labor in rural farming communities is an essential aspect to investigate when determining factors that influence rejection. In Zambia, it is a traditional custom for the farming labor to be divided among any and all able-bodied members of the family. The assistance of children is necessary due to lack of labor resources. In one study of the reliance on children for labor resources conducted across Lake Victoria borders in Uganda, Kenya, and Tanzania, Mwanja et al. (2007) reported the use of children in laborious tasks is frequent and common.

A study of gender and labor in rural Zambia, concerned with the equality gap between men and women, stated that "...a great deal of data was produced illustrating not only the huge workload faced by rural women, but their relative and increasing disadvantage in relation to men" (Harrison, 2000, p. 54-55). The necessary completion of large workloads required in a single day for subsistence living, contributes to lack of labor resources in other important areas such as cultivating maize, caring for gardens, or maintaining fishponds.

Predation

Predation of livestock, in fisheries, and of crops is a widespread limitation to farmers around the world. Common predators to fish in the *Zambian bush* are river otters, water monitors (large lizards), and a variety of birds of prey. In a study of

Ethiopian sugarcane growers, researchers Assefa, Van Den Berg, and Conlong (2008) reported half of the study's participants identified stem borers as one of the greatest limitations to their production of sugarcane. Some of the Ethiopian farmer participants from this study relied on natural control of the stem borers, while others utilized cultural practices. In a study of the golden apple snail in the Philippines, Joshi et al. (2001) reported the participating farmers regarded this particular pest as their main cause for yield loss. In a study of sweet potato farmers in Rwanda, participants reported pest damage as one of the five main constraints that limit their production of sweet potatoes (Placide, Shimelis, Laing, & Gahakwa, 2015).

Access to Fingerling and Harvesting Resources

Fingerling stock, which consists of small and newborn fish, is one of the most important agricultural inputs for fish farming practices. Without fingerling stock, farmers would not have fish to grow and sell. In Eastern Province, Zambia, fingerlings are typically procured from government-run stock ponds. However, these ponds can be mismanaged and often service such a wide catchment area that the ponds are perpetually under-stocked. Therefore, securing adequate fingerling stock is often one of the greatest challenges to fish farmers. Another critical challenge to fish farmers is the availability of harvesting resources, namely fishing nets. The average size of a pond is 10 meters by 15 meters. This size of pond requires a net to successfully remove all fish. Because fishing nets can be extremely difficult to find, and are often very expensive, farmers can typically be found using mosquito netting to harvest a pond. The government and health workers discourage this practice, as mosquito nets should be used solely for protection

against mosquitos. In some instances, a net can be borrowed from the local Department of Fisheries. But, in the case of this community, the local Department of Fisheries did not own a net, and instead located and borrowed a net from the provincial capital office of Chipata.

The mass majority of rural farmers in sub-Saharan Africa are found to be resource-deficient when evaluating their access to external agricultural inputs (Huis & Meerman, 1997). In a study of integrated irrigation systems found in Mali, Peterson and Kalende (2006) stated the participating farmers described high costs and insufficient availability of agricultural inputs were significant constraints to their fish production. Similarly, Kelly, Adesina, and Gordon (2003), in their study of recent market developments in sub-Saharan Africa, explained decades of slow agricultural growth was a result of increased cost of agricultural inputs, making these inputs inaccessible and unattractive to rural farmers.

Access to Financial Resources

For rural maize farmers in Eastern Province, Zambia, access to financial resources, credit, and loan services is a formidable challenge. This is due in part to the distance of farms and homes from the institutions providing this support, as well as institutional barriers and lack of representation. In a study of Zambian farmers and their access to agricultural extension, credit, and market services, Kalinda, Shute, and Filson (1998) determined farmers to be restricted in their access to credit services regardless of their considerable contribution to the nation's production of crops. This study recognized the nation's reliance on small-scale farmers to contribute substantial crop output to

support the agricultural industry. Credit allows farmers to improve yield and adopt new technologies (Vetrivel & Selvi, 2012).

Purpose of the Study

The purpose of this research was to identify and describe the factors that affected the rejection of fish farming innovations in rural Zambian farmers. The availability of this research to PCV trainees, current PCVs, and for extension agents at the Zambian Department of Fisheries, allow for a better understanding of certain influences that contribute to the rejection of fish farming innovations. This increases volunteers' capacity to work more efficiently and effectively in the given 24 months of service at their community post.

Statement of the Problem

The problem this study sought to address was the rejection of fish farming innovations in the rural farming community of Munendwe, located in Zambia. Anandajayasekeram, Puskur, and Zerfu (2009) suggested that, to ensure global changes benefit smallholder farmers, new mechanisms to foster the development and diffusion of innovation are needed to strengthen the ways in which information, knowledge, and technology are researched, developed and disseminated. The researcher, also the resident Peace Corps Volunteer, experienced challenges in promoting fish farming innovations throughout the 24 months of service in this particular community. A lack of understanding as to the specific causes for the rate of rejection was a determined challenge.

The researcher interviewed thirty farmers in the community to gain a better understanding of the barriers causing rejection of the innovation. Of these farmers, nine were female, and 21 were male. Rogers (2003) described rejection as a decision not to adopt an innovation. This research addressed gender, and whether or not its influence had an effect on the rate of rejection. This research also sought to address the seasonal calendar in which farmers regularly work. The gained understanding of the seasonal calendar, and when farmers have gaps of formerly unused time, would benefit a fish farming extension agent to be able to adjust the fish farming cycle for that village. In particular, if farmers stated that maize planting had to occur in December, instead of stocking fish as the RAP standard fish farming cycle states, the Peace Corps Volunteer could alter the cycle to be more compliant with the community's seasonal calendar. The Peace Corps Volunteer could then organize with the local Department of Fisheries to acquire fingerling stock one month later as a scheduling compromise. This understanding suggests ways to work fish farming into the seasonal calendar in a more realistic way, potentially influencing adoption of the more time-consuming techniques.

This research also described logistical barriers that encompassed transporting fingerling stock, and the availability of fingerling stock. Both of these potential barriers to adoption involve the community's relationship with DOF. DOF extension agents are tasked with accessing rural farming villages and collaborating with farmers to arrange the purchase and transportation of available fingerling stock. The researcher wished to describe these logistical challenges from the perspective of the active fish farmers, to be able to reach a better understanding of how DOF could help to influence adoption of fish

farming innovations, and to be able to share these recommendations with extension agents and future Peace Corps Volunteers.

Significance of the Study

Incoming RAP Peace Corps Volunteers to Zambia can receive access to a professional document that describes the theory of diffusion of innovations, and provides recommendations based off the research findings, to improve promotion of fish farming innovations. Through the use of face-to-face interviews with local farmers, PCVs can gain a better description of barriers influencing the rate of rejection in innovative fish farming promotion. This research is applicable to the RAP program as volunteers seek to promote relationships with the local DOF, and influence adoption of innovative stocking and harvesting procedures.

CHAPTER II

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theory of Diffusion of Innovations

The theoretical framework of this research was based on Rogers' diffusion of innovations theory. Rogers defined diffusion as, "...the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 5). An innovation is characterized as a concept, formerly unknown, and thus understood to be new and unpracticed to a particular culture or group of individuals. Communication is the act of passing information from one person or organization to another. A channel is the medium in which this communication is traveling. This can refer to organized mass media or informal interactions. The success of this communication is determined by the differences that may be perceived by those who are participating.

Heterophily vs. Homophily

Heterophily refers to these perceived differences. "Heterophily is the degree to which two or more individuals who interact are different in certain attributes" (Rogers, 2003, p. 306). Homophily is representative of what individuals have in common. Rogers' theory of diffusion stated that successful interactions that occur between individuals are most often made between those who are homophilous, "...communication between them is more likely to be effective" (Rogers, 2003, p. 306). Time is another determinant taken in to consideration when investigating diffusion.

Perceived Attributes

Rogers utilized several sets of characteristics to assist in defining diffusion. The first of these characteristics is perceived attributes. This list includes relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). Relative advantage represents the extent to which an adopter perceives the new innovation to be better than the last, whether it be related to the economy, technology, or a social advantage. The relative advantage of a new innovation will assist the adopter in determining whether the new innovation is worthy of replacing the original. The second attribute is compatibility. Measuring this attribute means to determine how much, or to which degree a potential adopter believes the innovation will fit into the current norm. Rogers' definition of this attribute emphasized compatibility within an individual's value system. "An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible" (Rogers, 2003, p. 15). Complexity refers to the ease in which an adopter can incorporate an innovation into their current status quo. Emphasis is placed on the ease of function and use of the innovation.

The next attribute, trialability, represents the availability an adopter has to test an innovation. The more opportunities a potential adopter has to test or experiment with the innovation, the greater the likelihood the adopter will choose to adopt. Finally, last in the list of perceived attributes, is observability. This represents the ability of potential adopters to observe the results from others giving the innovation a trial. "Past research indicates that these five qualities are the most important characteristics of innovation in

explaining the rate of adoption” (Rogers, 2003, p. 16-17). These characteristics are often used as tools of measuring adoption rates in research.

Innovation

Rogers (2003) defined an innovation as, “...an idea, practice, or project that is perceived as new by an individual or other unit of adoption” (p. 12). For this research, innovation refers to the fish farming innovations taught during the RAP program’s existence in the community. Sanginga (2009) stated that, “Farmers know better than scientists the criteria by which innovations will be judged and the objectives that the innovations have to serve. For farmers, many other criteria and objectives pertain...adoption is a voluntary act by farmers” (p. 18). By using Rogers’ model of the five stages in the Innovation-Decision Process, and by applying the concept of perceived attributes of innovations to this research, observations were made on the factors that influenced farmers to reject fish farming innovations.

Change Agents and Opinion Leaders

Rogers (2003) defined a change agent as an individual who is typically seeking to influence or assist potential adopters in embracing an innovation. Change agents may often be tasked with developing a need for change (Rogers, 2003). This can either be in personal change for individuals, behavior change, or within an organizational structure or institution, etc. The role of a change agent includes establishing an information exchange relationship with individuals they seek to influence, which leads to diagnosing problems, influencing adoption, and preventing discontinuance (Rogers, 2003). Change agents can be individuals with a diverse range of designations within a community or

organization. The roles of extension agents are often compared similarly to that of a change agent.

Opinion leaders are defined as individuals who exert their influence within a society (Rogers, 2003). Change agents utilize opinion leaders to assist and impact change within a group or system. Opinion leaders gain leadership credibility based on technical understanding, conformity to the system's values and norms, and approachability (Rogers, 2003). Opinion leaders often have a unique position in their society's leadership structure. Opinion leaders are involved in interconnected communication networks and with individuals that can be joined by the flow of information (Rogers, 2003). This position is advantageous to change agents in that a unique flow of communication can be utilized for encouraging the diffusion or adoption of an innovation.

Cultural Relativism

The culture of a particular society is exceptionally influential in innovation rejection or adoption. Cultural relativism is the understanding that every culture is unique, and one is not better than the other (Rogers, 2003). Understanding another culture should be objective, and based on the culture's needs and circumstances (Rogers, 2003). Rogers stated, "Each culture works out its own set of norms, values, beliefs, and attitudes that function most effectively for its people" (p. 441). Researchers conducting studies of the diffusion of innovations within foreign cultures are compelled to appreciate the cultural beliefs of a society will impact the data and measurement of results (Rogers, 2003).

Literature Review

Rogers' diffusion of innovations theory has been utilized as the theoretical framework for many agricultural studies, both internationally and domestically. In one such study, Mugonola et al. (2012) used Rogers' theory to research the adoption of soil and water conservation technologies in southwest Uganda. Strong (2013) utilized the diffusion of innovations to structure research on agricultural loan distribution to Mexican farmers. A study in Guatemala was conducted using the theory of diffusion of innovations to investigate business sustainability for international development (Silberg, Murphrey, Wingenbach, & Lombardini, 2013). Wynn, Coppedge, and Strong employed Rogers' theory to frame a study in Trinidad and Tobago focused on farmer adoption of Integrated Pest Management practices (2013). And in their agricultural research, Barton and An framed a study evaluating early adoption of wheat in East Asia utilizing Rogers' theory (2014).

Ali, Jan, and Anwar (2011) studied adoption of new methods of production and use of technologies in Pakistani farmers, to provide information to extension workers and policy makers that identifies factors causing low productivity. In a similar study, Ewusi-Mensah (2012) sought to determine the challenges associated with information technology diffusion in Ghana. In another study focused in Guatemala, researchers used Rogers' theory of diffusion to study agricultural innovation (Oleas, Dooley, Shinn, & Giusti, 2010). And, a study in New Zealand researched the non-adoption of sustainably focused practices in one region's vineyards and wineries, and found costs associated

with the innovations tended to outweigh the benefits gained (Cullen, Forbes, and Grout, 2013).

A study of farmers in Vietnam by Chi and Yamada (2002) concluded the decision to adopt or reject a technology was based on farmer perceptions of the innovation's usefulness in regard to their particular circumstances. This study exhibits Rogers' (2003) findings of relative advantage; that the extent to which an individual thinks or perceives the new innovation is better than the last, has an effect on adoption. When the usefulness of an innovation was proven, farmers were more likely to perceive the innovation favorably (Chi & Yamada, 2002). Demonstrating an innovation's relative advantage is an influential stage of diffusion.

Das and Tripathi (2014) defined extension education as, "...non-formal, out of school adult education through which adults and youths are educated how to live better by improving their farm and home, bringing desirable changes in knowledge, attitude and skill" (p. 467). However, the services provided by extension offices vary greatly in the international arena. In a study of extension services in Uganda, McCole et al. researched the function Rogers' diffusion of innovations theory played on the challenges faced in extension implementation (2014). In an extension program in Thailand, the diffusion of innovations theory was used to study factors affecting the adoption of a certain maize variety (Poolsawas & Napisintuwong, 2013). Lastly, in a study of technology adoption and extension services, Genius et. al utilized the diffusion of innovations theory to study adoption of innovations in Greek olive farmers (2013).

CHAPTER III

PURPOSE, OBJECTIVES AND METHODOLOGY

The purpose of this study was to identify the influences related to gender, culture, time, and logistics for active fish farmers in the village of Munendwe, Zambia that affected the rejection fish farming innovations. The availability of this research to prospective Peace Corps Volunteers, current Peace Corps Volunteers, and for extension agents at the Zambian Department of Fisheries, will allow for a better understanding of influences that contribute to the rejection of fish farming innovations. Access to this study is also advantageous for Peace Corps Zambia staff members, particularly those that design and implement the training for PCVs in the Rural Aquaculture Promotion program. An understanding of what contributes to rejection in fish farming increases volunteers' capacity to work more efficiently and effectively in the given 24 months of service at their community post.

Research Objectives

This study sought to identify barriers to adoption to better prepare future PCVs and PC Zambia staff in the development and implementation of training modules. The research objectives included:

1. Describe influences affecting women's' rejection of fish farming innovations and;
2. Describe influences affecting men's' rejection of fish farming innovations.

Research Design

A qualitative interview method was determined to be the most advantageous structure of data collection for this study. Sofaer maintained that, “Qualitative research methods are valuable in providing rich descriptions of complex phenomena; tracking unique or unexpected events... conducting initial explorations to develop theories...and moving toward explanations” (1999, p. 1101). Qualitative methods of study have been used for research in countless sectors, in both local and international arenas. The value of qualitative research methods has been acknowledged as not only supportive of quantitative research findings, but worthy of informing aspects of both practice and policy (Munn et al., 2014).

Qualitative methods of study have been used widely in the agricultural research sector. In one such study, Shortall (2014) used qualitative research methods to determine the effects of gender implications on a European Union rural development and farming program. Researchers paired qualitative methods with mixed methods research in a study to examine sustainable diets in rural South Africa (Claasen et al., 2015). Bieri utilized qualitative research methods in a study of the role of rural women in smallholder agricultural production in the Global South (2014). In a study conducted in Pakistan, Kazmi et al. (2014) used qualitative research methods such as case studies, interviews, and focus groups to conclude public institutes need to be strengthened before the transitional lag of indigenous to modern farming practices can be bridged. Using qualitative methodology, Moore sought to inquire about perceptions of advisory and extension services located in the Caribbean Islands (2014).

Qualitative research methods have also been widely used to study adoption in agriculture. In a study conducted in Ireland, Warren (2013) used qualitative methods to research and describe the adoption of agriculture in the Mesolithic-Neolithic transition. In a study conducted in Kenya, Batjes (2014) utilized qualitative methods to determine the adoption of recommended soil and water conservation operations. Qualitative methods such as interviews were used in a study focused in Germany to examine adoption of precision farming applications (Busse et al., 2014). On a more local scale, Reimer, Weinkauff, and Prokopy (2012) studied adoption of watershed agricultural management practices in Indiana using a qualitative research design. Also on the domestic level, researchers utilized qualitative methods to determine perceptions of farmers in regard to agro-ecosystem projects located in the state of Nebraska (Wortmann, Christiansen, & Glewen, 2005).

Study Area Description

This study was conducted in Zambia, a sub-Saharan African country slightly larger than the state of Texas, with a population of approximately 15,066,266 people (CIA, 2015). An estimated 52% of the country's labor force is employed in the agriculture industry, which includes fishing, farming and forestry (CIA, 2015). The study's population was located in a single farming community inside Eastern Province (one of Zambia's nine provinces). This province lies between the border of Malawi and the Luangwa River. As of the 2000 census, Zambia's Ministry of Local Government and Housing listed the population of Eastern Province at 1,306,873. Family units and individuals such as the farmers that participated in this study reside in homesteads made

of mud brick and thatch structures. Family housing units often included extended family members and marital in-laws.

Population and Sample

The target population of this research included the 30 active fish farming participants in the Rural Aquaculture Promotion program and fish-farming cooperative in Munendwe Village, in the district of Sinda, Eastern Province, Zambia. The actual population was approximately 300 households of Munendwe Village. The sample was a census of the 30 ($N=30$) fish farmers to address the two research objectives. Due to the small sample size, this study utilized 30 individual face-to-face interviews with the participating farmers. The study sample consisted of nine ($N=9$) female fish farmers and 21 ($N=21$) male fish farmers. The participants were all members of Munendwe Village, and were Zambian citizens aged 22 years old and older.

Data Collection

This study utilized 30 face-to-face interviews. DiCicco-Bloom and Crabtree (2006) suggested individual in-depth interviews allow the interviewer to delve deeply into social and personal matters. They defined face-to-face interviews as characterized by synchronous communication in time and place. This study has a high degree of trustworthiness and credibility due to the researchers time of immersion and prolonged engagement in the community (Dooley, 2007). The researcher lived in the community for 22 months and worked as a Peace Corps Volunteer before the interviews and subsequent data collection began. Certificates citing the participation in fish farming

research were provided to interview participants. These incentives helped increase the response to interview invitations and participation (Dillman, 2011).

This method of data collection allowed for the researcher to employ the assistance of a language translator, with whom the researcher had previously worked for 22 months, to ensure the best and most accurate translation of responses. The researcher and participants communicated in the language each participant felt most comfortable speaking. The translator was available to facilitate complete understanding between each party. A face-to-face method was deemed the most appropriate to account for most accurate responses. This qualitative method of data collection allowed the researcher to obtain farmer testimonials that provided insight into potential causes for rejection of innovations in fish farming. After completion of the interviews, member checks were utilized with more than 50% of the participants to confirm the understanding of ideas and facts collected.

It was pertinent to this research that the population be interviewed about their feelings and attitudes toward innovations in fish farming to aid in the understanding of what was affecting the rate of rejection in this specific community. Opdenakker (2006, para. 7) indicated, “Social cues, such as voice, intonation, body language, etc. of the interviewee can give the interviewer a lot of extra information that can be added to the verbal answer...” The availability of supplementary cues supplied the researcher with the tools to understand how and why the farming community made decisions.

An unstructured interview process was utilized to collect information from participants in this study. Axelson et al. (2010) concluded the unstructured interview

format was individually more reliable in their medical education research study, which sought to investigate the difference in reliability between structured and unstructured interviews. In their research of unstructured interviews, Hawamdeh and Raigangar (2014) suggested improving this means of data collection by ensuring the process is culturally sensitive, and encouraging researchers to be in good understanding of the cultural elements of a population. The data was analyzed using the constant comparative method (Boeije, 2002).

The interviews analyzed in this study were conducted during the months of April and May of 2015. Before conducting the individual interviews, the researcher had been living and working among the community as a Peace Corps Volunteer since May of 2013. Interviews took place in the field; selecting times and locations occurred informally. A well-respected and highly educated member of the community was chosen and utilized as the language interpreter. Languages spoken included the Bemba dialect of Nyanja, as well as English. All identities were kept confidential and no personally identifying information was collected during the interview process. An information sheet was provided to potential participants prior to arranging or conducting individual interviews. This study was reviewed and approved by the Institutional Review Board in compliance with Texas A&M University's Human Subject Research requirements (IRB2015-0170D).

Research Questions

The questions asked in the face-to-face surveys included:

1. What kind of physical labor did you receive with caring for your fish pond(s) this year, specifically from the people in your household?
2. What is an example of a challenge you faced in harvesting the fish pond(s)?
3. Did any members of the community help you with the physical labor of digging your fish pond(s)?
4. How did you include fish farming in your seasonal farming calendar this year?
5. What new techniques did you implement in the way you cared for your fingerling stock this season?
6. If you did not implement new techniques, why not?
7. What kind of mortality rate did you experience during your transportation of fingerling stock from the village to your pond?
8. Can you explain the challenges you faced in transporting the fingerling stock you received from the Zambian Department of Fisheries to your pond?
9. In the past year, if the Department of Fisheries Extension service has been unable to provide you with fingerlings, have you found them available elsewhere?
10. What type of financial support have you received in the past year, from the Zambian Department of Fisheries in Petauke District?

Study Limitations

The presence of a language barrier between the sample population and researcher was a noted limitation. In a rural village setting such as the one this research took place, it was exceptionally important to recognize the barrier of having a common language.

English is currently the national language of Zambia, but in rural areas, English is rarely spoken, and in this instance, Nyanja, a local dialect of the Bantu language, is the language most commonly used. Other limitations included cultural barriers. In this case, members of the village may have been weary of participating in a study, and might have chosen to give the answers that they believed the researcher hoped to hear.

CHAPTER IV

FINDINGS

Objective One

The first objective for this study was to describe influences affecting the rejection of fish farming innovations for the nine female farmers that participated in the fish-farming cooperative. This cooperative consisted of thirty farmers total, and of these farmers, nine were female. Of these nine females, one identified as an experienced fish farmer. The remaining eight identified themselves as first-time fish farmers, with little to no experience in maintaining a pond or keeping fish. By interviewing these farmers in an informal face-to-face manner, the researcher gained further insight into the influences affecting the rejection of fish farming innovations.

Research Question 1: What kind of physical labor did you receive with caring for your fish pond(s) this year, specifically from the people in your household?

When asked this question, six of the nine female farmers (F22, F24, F25, F26, F27, F28) mentioned the assistance their children provided. These women reported that “the children are helping me every day” (F22), “the children were a great help to me” (F24), “only the children are providing me with help” (F25), “I go to the pond with the children every day” (F26), “the children dug the pond” (F27), and “I have one concrete pond that I care for, just me and my children” (F28). Each of these fish farmers were also responsible for maintaining an average of one to three hectares of fields growing crops such as maize, sunflower, and ground nuts. For this particular village, and many others surrounding it, the maize crop is the most vital to the income of farming families.

This is in part due to the Zambian Federal Reserve Agency coming through each year to purchase thousands of kilograms of maize product from rural Zambian farmers. In Zambian culture, and particularly rural village culture, the share of labor in the fields is spread among every family member that is able to work. This often includes young children and both adult men and women. In this community, it is very common for each household to also maintain a garden where food for family consumption is produced. The responsibility to maintain the garden falls predominantly on the female members of the family unit.

The remaining three women (F23, F29, F30) reported the work of the fishpond fell either solely to them and no one else, or they received support from extended family members, “I am only supporting myself” (F23), “I go to the pond everyday to feed the fish” (F29), and “I am a widow, my parents and brothers come from the next village to help me” (F30).

Research Question 2: What is an example of a challenge you faced in harvesting the fish pond(s)?

Peace Corps Volunteers in the RAP program are taught to create a seasonal calendar of common seasons in the village in which farmers are most likely to plant and harvest. Each villager might keep to a specific calendar that suits them as an individual, but it is common for the village to share a regular schedule that is determined by the amount of rain, and the timing of the rains each year. In the case of this village, the assigned PCV encouraged the thirty members of the fish farming cooperative to harvest approximately 6 months after the stocking of the pond. The farmers were encouraged to

harvest multiple times after this date, for either the purpose of selling or consuming. Due to the nature of the rainy and hot seasons, it was expected for these earthen ponds to evaporate and become dry before the hot season was complete. A complete harvest of all the fish from the pond was encouraged before the pond water levels drained to less than half full. The purpose of removing the fish before the water became exceptionally low was to prevent predation of the remaining fish by predators such as fish eagles, river otters and water monitors. Low water levels leave fish in a vulnerable state.

To assist with the harvesting procedure, members of the cooperative were encouraged to make use of a fishing net, which the researcher had secured from the local Zambian Department of Fisheries. This net was provided for a total of three weeks and was kept in a common location inside the village with the understanding that it would be returned each evening to allow for the net to be used by another farmer the following morning.

More than half of the responses to research question two reported challenges faced in harvesting the ponds. Of these participants, seven of the nine (F24, F25, F26, F27, F28, F29, F30) reported an unsatisfied result with the harvest in general, “none for selling, there were predators” (F24), “a water monitor came and took them all” (F25), “we harvested with the DOF net but it was very bad, the predators had removed the remaining fish” (F26), “fish were there, but the net was too big” (F27), “I harvested two times, not many fish because of the birds...we just ate them as our meal” (F28), “harvest occasionally for meals” (F29), and “many problems, a water monitor went into the pond and birds took out the fish as well” (F30). Many of these unsatisfied responses were

from ponds affected by frequent predation. Only the remaining two female participants (F22, F23) reported more satisfied experiences, “harvested three times...first and second time for feeding the family, third time we are selling” (F22). Another participant reported using a different harvesting technique, “harvested three times, the successful tries were with the mosquito net. The net from DOF was too big” (F23). This participant was able to sell the majority of her fish and made a profit of 85 ZMK on each occasion. At the time of sale, this amount of local currency was equivalent to \$12 USD.

Research Question Three: Did any members of the community help you with the physical labor of digging your fish pond(s)?

Research question three encouraged discussions that would lead the researcher to discover the level of support individual fish farmers might experience from fellow neighbors or farmers in the village. Construction of a RAP standard earthen pond required the use of at least a shovel or shovel-like tool, and could be accomplished by any able-bodied person. However, digging a 10-meter by 15-meter pond that is advised to be at least 1.3 meters deep, can take an exceptional amount of time to complete for an individual person.

Of the nine female participants, six (F22, F24, F25, F26, F27, F29) reported digging the ponds themselves, or recruiting the children in the family to assist. These six stated their help came from “just myself and my children, there was no one else” (F22), “no help” (F24), or that “the children helped me to dig, but I did most of the job myself” (F25), “my children...I did not help” (F26), “just the children” (F27), and “it was just my 17 year old son” (F29). The remaining three reported either having hired a day

laborer (F30) or owning concrete ponds at their place of residence that did not require any further construction (F23, F28).

Research Question 4: How did you include fish farming in your seasonal farming calendar this year?

As previously mentioned, each village in the rural farming communities of Zambia, have a common seasonal farming calendar adhered to by most residents. For example, the majority of maize farmers might plant in the beginning of rainy season, December, and harvest in June. This depends very heavily on when the rains begin to arrive. Carving out a time for fish farming activities and cooperative meetings in an established seasonal calendar is essential to extension workers or Peace Corps Volunteers when entering into a village for the first time. This information allows volunteers an opportunity to increase the likelihood of adoption by ensuring fish farming activities are suggested for open “gaps” in the community’s seasonal calendar. This research question sought to identify how the farmers in the cooperative divided their time, and whether adding fish farming to the schedule posed any unique challenges.

Seven of the nine female fish farmers responded positively about their experience adding fish farming to their schedules (F22, F23, F26, F27, F28, F29, F30). The majority of the responses reflected having ponds located inside garden plots motivated participants. Participant F22 stated, “this is not difficult, everything is close (to the pond)”, followed by “caring for the ponds was easy...I added it to my routine” (F23), “I was happy to be adding fish farming to my schedule. It was not a problem. The fields and the garden are all close to the village” (F26), “no problem incorporating fish

farming, I went there every day in the mornings” (F27), “pond is directly at my home, caring for the pond is not a problem” (F28), “happy with the times I stocked and harvested, I will keep the same schedule next year” (F29), and “time is shared between garden, pond and fields. I am receiving help from my family” (F30). The remaining two participants reported problems with caring for the ponds (F24, F25), “supervision was difficult, when attending to the pond, sometimes pigs would get into the fields” (F25), and “it is difficult to keep feeding the fish. There is very little food left” (F24).

Research Question 5: What new techniques did you implement in the way you cared for your fingerling stock this season?

Throughout the Peace Corps Volunteer’s two-year service in the community, approximately a dozen group meetings, or seminars, were conducted with the fish-farming cooperative. The objective was to teach and discuss innovations in fish farming that pertained to the season. For example, several weeks before stocking the ponds in January 2014, two cooperative meetings were held to instruct and demonstrate proper fingerling stocking techniques. Similar seminars were held for pond management techniques, feed demonstrations, harvesting, etc. Attendance of the 30 participants varied throughout the two fish farming seasons. Due to the difficult nature of organizing many farmers to meet at once, individual site visits and pond evaluations were available to the farmers at any time. These voluntary meetings were arranged at the discretion of the farmer, however at the minimum, two consultations were scheduled and completed for each farmer. The first was a site visit to discuss the construction of a pond, or for

some, the evaluation of a currently existing, traditional pond. The second was the interview used as the data for this study.

Examples of techniques for caring for a fishpond taught in these seminars include:

1. Sloping of pond walls during construction- to prevent soil deterioration, and allow a place for the fish to build nests for breeding
2. Feeding- ground corn husks (gaga), vegetation, rotten fruits, and leftover vegetable table scraps
3. Slashing or cutting grass in and around pond- manage predation
4. Manure bags- fertilizing the pond to encourage growth of phytoplankton
5. Fencing- installation of thorn fences in and outside pond to deter predation and theft

Eight of the nine female fish farmers (F22, F23, F24, F25, F26, F27, F29, F30) responded to this question in a manner that suggested they had learned and put into practice the new techniques for caring for their fish and pond. Participant F22 detailed how she was “keeping the grass low, to keep out the frogs and water monitors. And I am putting in the bags of manure to keep at the bottom of the pond”. Other participants added, “I learned to add the manure” (F23), “I put many trees and branches into the fish pond to give the small fish a place to hide from the predators” (F24), “I learned to protect the pond from predators by adding thorns or a fence” (F25), “the ponds must have sloped walls, a shallow and deep side, and we must be feeding gaga very often”

(F26), “I added manure in the pond as we were told” (F27), “I have provided more food to the ponds and the walls of the pond are sloped” (F29), and lastly “I only knew to be feeding and checking the growth. This was my first time with a pond” (F30). The remaining female farmer, participant F28, described how she was not involved in the farming cooperative, “I did not attend the meetings and I do not know these different ways of caring for the fish...”

Research Question 6: If you did not implement new techniques, why not?

This question did not apply to many of the female fish farmers because eight of the nine described one or more techniques they implemented in their fish farming practices in research question five. The remaining participant who did not implement new techniques responded that “this is my first time and I want to learn more in the future” (F28).

Research Question 7: What kind of mortality rate did you experience during your transportation of fingerling stock from the village to your pond?

The collection and transportation of fingerlings is typically known as a difficult and arduous task in the rural village. Prior to the introduction of the RAP program in this community, fish farmers had to ride a bicycle over bush paths and gravel roads a distance of up to 50 kilometers (approx. 30 miles) round-trip to purchase the fingerlings required to stock their ponds. In 2014 and 2015, the local Zambian Department of Fisheries was petitioned to assist the farmers with this task. The fingerling pick-up and transport was a gifted service provided by this government office. The transportation of these fingerlings, by vehicle, to a common meeting area in the center of the village was a

tremendous improvement to previous transportation methods, and greatly reduced the amount of time the fingerlings spent in an oxygen-depleted plastic bag. This also reduced the amount of time the fish spent exposed to the heat. These two factors are the most common way in which fingerlings die during the transportation process.

This service led to low mortality rates for six (F22, F23, F27, F28, F29, F30) of the female fish farmers. An acceptable mortality rate is 10% or less fish dying in the first day. The six female farmers with the low mortality rates responded, “none of the fish died, they all lived” (F22), “only 10 out of the 150 died” (F23), “they all lived” (F27), “only two of the 400 died they day they were delivered” (F28), “17 died from being carried to the pond. We were happy with the number of fish in the pond” (F29), “I carried them in the bag, only one kilometer, there were no problems” (F30). The remaining three female fish farmers reported dissatisfaction with the mortality rate they experienced, “many died the first time, we do not know why” (F24), “difficulty with the new fish dying on the first day. I did not understand why” (F25), “many of my fish died, I carried them to the pond in a dish, about 30 died” (F26).

Research Question 8: Can you explain the challenges you faced in transporting the fingerling stock you received from the Zambian Department of Fisheries to your pond?

The transportation of the fingerling stock to the village by the local Department of Fisheries vehicle was a grand improvement to the way in which the fish farmers previously acquired fingerlings. Each of the nine female fish farmers responded positively to research question eight. None of the female fish farmers responded

transporting the fingerling stock to their pond was a challenge during the 2014 and 2015 fish farming seasons. The majority of the farmers explained, after the fingerlings were delivered, they carried the fish a short distance from the centrally located distribution point in the village, to their individual pond.

The fingerlings, each no more than one or two inches long, are stored in large plastic bags after being removed from the government ponds. These large industrial plastic bags are filled with roughly 200 fingerlings each. The plastic bag will usually be filled to 50% capacity with water, and the remainder of the space is pumped full of oxygen. A rubber band is used to secure the opening of the plastic bag, and the multiple bags are stored in the back of the Department of Fisheries pick-up truck. Often, a fishing net will be laid on top of the plastic bags to provide protection from the sun while driving to the distribution point in the village, in this case a distance of approximately 25 kilometers (15 miles).

The female fish farmers described transporting the fingerlings from the distribution point to their ponds, “I carried the plastic in a large bucket, on my head, and walked to the pond. It was okay” (F22), “we were lucky to have DOF deliver the fish directly to us. I only had to carry the bags a short distance” (F23), “I was just carrying the plastic to my pond, this was not a far distance...” (F24), “this was not a challenge for me, the plastic was put into a basin, and I carried it two kilometers to the pond” (F25), “I walked with them in a basin on top of my head, the fish were delivered in the village by the Department of Fisheries” (F26), “we put the plastic inside a dish and walked together there, no problems. We were very happy they were delivered to the village” (F27), “we

transported them very easily because of the delivery from DOF” (F28), “it was easy to transport them because the DOF extension agent came to the village” (F29), and “there were no problems” (F30). No compensation to the Department of Fisheries or the extension agent was made for this service. The fingerling distribution that occurred in 2014 was the first time this service had ever transpired. The same routine of fingerling transport and delivery occurred in the beginning of the 2015 fish-farming season as well.

Research Question 9: In the past year, if the Department of Fisheries Extension service has been unable to provide you with fingerlings, have you found them available elsewhere?

There were instances throughout this two-year RAP program that the fingerling supply from the government ponds came into question. The availability of a fingerling supply was not always described as a guarantee by the government pond workers, or by the Department of Fisheries extension agent himself. The instability of the government stock inspired an interest to discover alternative methods of acquiring healthy fingerlings. However, out of the nine female fish farmers, only one had previous experience in purchasing fingerlings. This participant reported, “I have bought from the government ponds before, the prices were the same but we had to travel very far” (F29).

The remaining female fish farmers (F22, F23, F24, F25, F26, F27, F28, F30) responded with a lack of experience in purchasing fingerlings, “I do not know where other fish can be found” (F22), “I have not bought any fish before” (F23), “this was my first time purchasing the fingerlings for my pond” (F24), “I have never bought fish from DOF before” (F25), “this was my first time getting the fingerlings, the fish, from

anyone” (F26), “this is my first time ever” (F27), “I have never bought them before” (F28), and “this was my first time to buy the fingerlings” (F30).

Research Question 10: What type of financial support have you received in the past year, from the Zambian Department of Fisheries in Petauke District?

In 2014, the fish farmers in this rural community made their first official order for fingerlings to the local Department of Fisheries office in Petauke District. It was at this time the local extension agent for this office offered a discount program for first-time fish farmers. The offer was for all female fish farmers, fish farming for the very first time, to receive their entire order of fingerlings for free. This was announced several months prior to the optimal stocking season, as to encourage more women to dig ponds for themselves. Then, the offer was extended for a 50% off discount for all men who were farming fish for the first time. The following year, 2015, the Department of Fisheries office was unable to provide any discount, and every farmer regardless of gender, had to pay the full price. The full price for stocking an average-sized fishpond was approximately 55 ZMK. At that time, this was equivalent to \$11 USD.

The discounted fingerling program and the fingerling delivery service were very well received by participating farmers. When asked about any financial support they might have received in regard to stocking their ponds, the nine female fish farmers shared similar responses, “last year, my fish were a gift from DOF for being a woman” (F22), “last year the fish were free, this year I paid 50 ngwee for one fish each” (F23), “the first year I received all of the fish as a gift, for a government program to encourage women” (F24), “the fish were free last year for women’s programs” (F25), “the first

time, the fish were free for programs for encouraging women, the second time, I am quite ready” (F26), “the fish were free last year for being a woman and farming for the first time, this year I am paying for them myself” (F27), “100% free for women’s government program, this year I am paying for all of the fish” (F28), “there is no one else growing fingerlings, we must go to DOF. After last year there is no program for women, we have to pay for each fish” (F29), and “the first year, they were free from DOF. The scheme for giving females because it is supportive and encouraging is very good, but now, it is okay to pay” (F30).

Objective Two

The second objective was to describe influences affecting the rejection of fish farming innovations for the 21 male farmers who participated in the fish farming cooperative. From this group of participants, eight farmers identified as experienced fish farmers. This referred to someone who had previously kept a traditionally managed pond stocked with fish at some point in time. The other thirteen male farmers identified themselves as first-time fish farmers, indicating little to no experience in maintaining a pond or keeping fish. By interviewing these farmers in an informal face-to-face manner, the researcher gained further insight into the influences affecting the rejection of innovations in fish farming.

Research Question 1: What kind of physical labor did you receive with caring for your fish pond(s) this year, specifically from the people in your household?

Eleven of the 21 male fish farming participants (F1, F5, F8, F9, F10, F11, F15, F17, F18, F19, F20) reported family members from their household assisted them on a

regular basis. These participants explained, “everyday we are going there, to the pond, my whole family is helping” (F1), “I am going everyday, my wife and children come too” (F5), “I visit the pond everyday, but sometimes it is my wife or my children...to check the status” (F8), “...together with my son. Three times a week we are there...my wife also holds a big responsibility with the pond, she is very committed” (F9), “I do the work myself, but sometimes my family comes” (F11), “I visited the pond many times a week, but when I was away for school, my wife cared for the pond” (F15), “my two sons, age 18 and 17 helped me at the pond. We shared the responsibility between the three of us” (F17). Similar responses included, “the boys in the family are the ones that help feed the fish. The work is not favorable for girls” (F18), “I visit the pond every day to check on the fish and to put gaga in the water for food...wife and children accompany me, and will do the work if I can not go” (F19), and lastly, “I visit the pond three or four times in one week...children help to feed in the morning, and my wife only some of the times” (F20).

Eight of the 21 male fish farming participants revealed they do the work of caring for their pond completely by themselves. Participant F2 does not identify as a first time fish farmer, but a fish farmer with 17 years of experience. He explains, “every day, it is only me going to the pond”. The remaining seven of those reported being the sole caretakers of their ponds echoed similar sentiments, “I am visiting the pond daily, I want to monitor to see if the fish are still good” (F3), “I built the pond with just myself” (F4), “I care for the fish alone, no one helps me” (F6), “I visit the pond everyday, I am feeding gaga one time a week” (F7), “my wife did not support me in this, and my children are

too small. I cared for the pond only by myself...no one would help me” (F13), “I take care of the pond myself...never my wife” (F16), and lastly, “I was in charge of the pond, no one else helped me” (F21). The two remaining participants (F12, F14) report hiring a piece worker to regularly care for their pond, “I employed a worker to go everyday, in the mornings...” (F12), and “I hired someone to take care of the garden and pond, everyday he is there.” (F14).

Labor

As previously mentioned in the findings for Objective One, six of the nine female fish farmers responded they received help caring for the fishpond from their children. Three responded the work is done individually on their own. Of the male fish farming participants, eleven claimed the bulk of the labor is shared among themselves, and their children. However, eight others responded they do the work alone. The last two male participants were the only members who reported hiring day laborers to assist at the pond.

The availability of labor is an essential aspect to investigate when determining factors that influence rejection. In this community, the labor of children is relied upon heavily as there is very little assistance available elsewhere. Most farmers, as reflected in the interview responses, did not hire outside help when caring for their pond. It is a traditional and cultural custom for the farming labor to be divided among any able-bodied members of the family. The assistance of children was necessary due to lack of labor.

Gender

It is also imperative to mention the differences in responses to this question in specific regard to gender. Women were more likely to report the aid and assistance they received from children or other family members. Those female participants that reported the assistance they received did so immediately, without further prompting to explain. When those male participants were prompted to further explain how their pond is maintained each day, only then would the help and supplemental labor they received from members of their family, specifically the children, be mentioned. Also, there were no instances in which a female fish farmer reported receiving help with the pond from her husband.

Research Question 2: What is an example of a challenge you faced in harvesting the fish pond(s)?

From the 21 male fish farmer participants, 16 expressed having one or more challenges with the harvesting process (F3, F5, F6, F7, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F20, F21). Of these 16 fish farmers, nine identify the poor quality of the Department of Fisheries fishing net as their foremost challenge related to harvesting their ponds (F6, F7, F9, F10, F11, F13, F14, F18, F21). This weighted fishing net was allocated to the fish farming cooperative members for a total of three weeks, for the use of harvesting their ponds.

The majority of these nine participants shared similar sentiments that the size of the net was too large, “we used the net from Department of Fisheries, but it was too big, we took very few fish...” (F6), “...we used the net from DOF, but we had challenges. We finished by using a mosquito net” (F9), “we did not harvest our pond. The net from

DOF was too big” (F10), “water was very low, but the net was too big” (F11), “the DOF net was too big, and not helpful. I used a mosquito net and harvested the fish...” (F13), “...it was very difficult, the net from DOF was too big” (F14), “...net from DOF was very big and the fish escaped from the holes. We used the mosquito net instead” (F18), and lastly, “we did not have a good net to use, the net from DOF was too big and the fish were escaping” (F21).

Of the 16 participants with challenges in harvesting, the remaining seven identify predation as the foremost problem (F3, F5, F12, F15, F16, F17, F20). “We had very many problems with the river otters eating our fish” (F3), “there are no fish in my pond today. The predator bird are a very big problem” (F5), “we experienced setbacks because of otters” (F12), “...most were stolen, we did not sell anything” (F15), “I harvested when the water was low, the birds had already stolen most of the fish” (F16), “the river otters and the Kingfisher birds were the biggest problem. They stole many fish and when harvesting, only a few were left...we used a mosquito net because it works very well” (F17), and “the fish eagles and the water monitors are the biggest problems. They steal from the ponds and leave just the very little fish” (F20).

The remaining five participants are those who did not report any challenges with their harvesting experience. “No challenges, I used my own net, took some here and there...several times” (F1), “I have harvested many times, some for selling and some for eating” (F2), “we are happy with our catch. We used the net from the fisheries department and sold the extra fish...harvested many times” (F4), “we harvested the pond five times...used a hook and sometimes we use a net we bought from the shops” (F8),

and “in August, I started harvesting each week, just enough for a meal for my family. I used a net I had for myself” (F19).

The fishing net from Department of Fisheries was supplied to the fish farming cooperative members, but some farmers chose to use other materials. Five of these 21 male farmers reported using mosquito nets (F2, F9, F13, F17, F18). The holes in mosquito nets are significantly smaller than fishing nets, and typically allow for more fish to be caught at one time, making it a tool that is easy to use.

Research Question 3: Did any members of the community help you with the physical labor of digging your fish pond(s)?

With this question, the researcher sought to gather insight on whether or not fish farmers were seeking the assistance or support of their peers in the community, and if so, what type of support they were seeking. When the fish farmers use the term “piece worker” it is defined in their culture as someone who has been hired or employed by another. This worker is someone typically picking up different short-term jobs each day, often involving manual labor.

Of the 21 male participants, ten reported digging their ponds with no help (F2, F3, F5, F6, F7, F9, F13, F18, F19, F21). “...I am digging myself” (F2), “no, I have dug the pond myself” (F3), “no, I was digging just myself” (F5), “no, I dug the pond alone” (F6), “no help from the community, I dug the ponds myself” (F7), “I was digging the pond myself” (F9), “no, digging the ponds took three months by myself, no one helped me” (F13), “no the pond was built by me only” (F18), “no, it was just me that was

digging the pond” (F19), “no, I did not hire anyone, and I dug the pond for myself” (F21).

Of the remaining male fish farming participants, six described experiences in which they hired workers to dig the ponds for them (F1, F8, F10, F12, F14, F15). “Yes, I used help, I hired some piece workers to dig the pond for me” (F1), “I hired two piece workers to dig the pond” (F8), “no, I hired the men to dig the pond” (F10), “I employed a worker to dig the pond, the contract was completed...” (F12), “I employed piece workers to dig and care for the pond” (F14), and “I hired three men to dig the pond, I did not have time to do it myself because of school” (F15).

The last five participants responded to research question three with experiences detailing the support and assistance they received from members of their family. “It was a family effort” (F4), “me and my son only...no one else was able to help us, we did the work ourselves” (F11), “my son helped me to dig” (F16), “...just my sons” (F17), and “...I dug the pond myself with my two sons helping. It took us one month to complete the pond” (F20).

Research Question 4: How did you include fish farming in your seasonal farming calendar this year?

Of the 21 male participants, 17 responded having little to no challenges with integrating their fish farming practices into their pre-existing seasonal calendar (F1, F2, F3, F4, F5, F6, F7, F9, F10, F11, F12, F13, F16, F18, F19, F20, F21). “It was not difficult...” (F1), “...pond is one kilometer away, I am going there everyday, no problems” (F2), “there are no problems in doing both, the pond is near” (F3), “I go two

times a week to feed gaga and worms. I like to see that the fish are growing” (F4), “I am farming maize...there are no problems also being a fish farmer. The garden and the pond is close to my home” (F5), “my pond is close, so are the maize fields. I am going to the pond five times a week...” (F6), “we were determined and we managed” (F7), “this was not difficult because I have assistance from my family. Watching the fish is a hobby” (F9), “it was not a problem incorporating fish farming, my son was the manager” (F10), “I go to the pond three to four times a week. It is easy because the pond is at my garden, so I care for both things at the same time” (F11), “this was not a challenge because of the worker we hired” (F12), “I had no problem caring for the ponds and fields at the same time, I visited the pond at least three times a week” (F13), “I am a farmer of maize, groundnuts and sunflower. Fish farming is good farming because once you have a pond, you can get more things...” (F16), “no problem with traveling to maize fields and pond in the same day. It is best to have the pond inside the garden” (F18), “there was no problem taking care of both...I do not have to travel far” (F19), “this was not a challenge. My fields and the pond are very near to the village” (F20), and “I visited the pond many times in a week...it is not a problem to be visiting many times a week” (F21).

The remaining four participants expressed their difficulties incorporating fish farming activities into their standard seasonal farming calendar (F8, F14, F15, F17). “It is very difficult to visit the ponds, when we are busy in the fields we become very exhausted” (F8), “I am a poultry farmer, this is my main income, it was difficult finding time for fish ponds” (F14), “I go in the afternoons when I can, my pond is far from my

home” (F15), and “this was difficult. Going to both places in one day took very much time” (F17).

Time Management of Fields and Ponds

When determining which interview questions would assist the researcher in discovering the factors that influence the rejection of fish farming innovations, time management was suggested as a potential deterrent. However, the participants’ responses proved otherwise. Of the nine female fish farming participants, only four of these reported time management between the fishpond and their fields as a challenge. Of the 21 male fish-farming participants, only four of these reported a similar experience.

As it seems, due to the nearby vicinity of most farmers’ fields, managing both responsibilities was a reasonable and achievable task. Farmers reported their success and intention to keep the same time management and seasonal calendar as had been proposed to them during the introduction of the RAP program in the community. To discover that time management was not determined to be an issue influencing the rejection of fish farming innovations, was an unexpected but impactful finding of this study.

Research Question 5: What new techniques did you implement in the way you cared for your fingerling stock this season?

Eleven of the 21 male fish farming participants reported practicing new techniques (F1, F2, F3, F6, F9, F12, F13, F14, F15, F17, F21). “This is my first time, everything was new” (F1), “I have added manure as fertilizer so the fish are growing faster” (F2), “I acquired lessons and knowledge because of membership in the fish farming cooperative” (F3), “I am feeding the leftover food, I did not know the fish could

be eating our food” (F6), “I did not know anything about keeping fish, I learned many things...we built the ponds with sloped walls, and we fed food from the table” (F9), “we put manure in the pond and fed gaga...pond was dug with sloped walls for the fish to make the nests...did not know to do this before” (F12), “I removed the grass as I was told to do. I learned fish we bring to the village need more food than in a river” (F13), “I dug the pond in a way I did not know before...all the ideas were good” (F14), “...learned to slash the grass around the pond to keep away predators. My new pond is not as deep. This helped when harvesting” (F15), “the DOF extension agents taught me many things...” (F17), and “I built the pond to have sloping walls. This is not traditional, we also add manure for fertilizing” (F21).

The remaining 10 male participants revealed they had not learned any new techniques from participating in the RAP program and continued with traditional practices (F4, F5, F7, F8, F10, F11, F16, F18, F19, F20). “I did not do anything new, traditional practices only” (F4), “I did not do these things” (F5), “we did not do any new ideas at the pond” (F7), “no new techniques, I am feeding the same, I did not learn anything” (F8), “I did not do anything new” (F10), “I did not do new techniques, I did not want to dig a new pond, to start over” (F11), “I did not do new methods with my pond” (F16), “I did not learn anything, I have the same knowledge as before” (F18), “I did not implement anything new, I learn only from experience” (F19), and “no new techniques, I did not learn anything different” (F20).

Research Question 6: If you did not implement new techniques, why not?

In Objective One, the researcher described how research question six did not apply to the majority of the female participants because eight of the nine reported they used new techniques in their fish farming procedures. As for the male fish farming participants, 11 of the 21 responded they implemented one or more new techniques. The remaining ten male participants (F4, F5, F7, F8, F10, F11, F16, F18, F19, F20) did not implement new techniques. They responded, “this was my first time, I want to try more methods of protection next season” (F5), “I did not learn any new ideas” (F7), “I want to build more ponds, these will have the sloped walls. I will build a fence for protection” (F8), “I did not learn anything” (F10), “there was no difference, it is just the same” (F11), “I did not have time. Next year I will build a fence for protection from predators” (F16), “I want the opportunity to learn more, because I have not learned anything” (F18), “I did not have time, I was helping to coordinate the fish programs” (F19), and “I want to learn how to protect the fish from the birds...will try building a fence and adding thorns...” (F20). Participant F4 chose not to disclose a response to this question.

Culture

Of the male participants, ten farmers replied they had not chosen to implement any of the techniques taught or discussed throughout the duration of the RAP program in their community. However, of those ten, five reported a desire or future plan to either change their traditional methods of fish farming, or to become more involved in the fish-farming cooperative. Also, the one female participant that reported her rejection of innovations in fish farming, also reported her intention to learn more in the future.

The emerging theme that occurs from inquiring about rejection of new techniques is based on culture. Prior to the involvement of Peace Corps and the RAP program, farmers of the community in which this research took place reported little to no exposure to fish farming innovations. Traditional methods of farming and building fishponds were customary, and modern methods were unknown. A total of eleven fish farmers, both male and female, originally rejected innovations in fish farming. However, out of this eleven, six discussed their intentions to adopt new techniques to improve their fish farming experiences. For these six farmers, the original decision was to observe traditional methods of fish farming. However, after experiencing challenges, these farmers reportedly made the decision to adopt innovations of fish farming in the future.

Research Question 7: What kind of mortality rate did you experience during your transportation of fingerling stock from the village to your pond?

Of the 21 male participants, 15 reported experiencing low mortality rates on the day of stocking (F1, F2, F3, F6, F8, F9, F10, F11, F12, F13, F14, F17, F18, F20, F21). A low mortality rate is described in the RAP program as the death of 10% or less of the total number of fish stocked. These farmers expressed having little to no problems, these descriptions include, “I do not remember any of the fish dying on that day” (F1), “just two died last year, very few” (F2), “very few fish had died in 2014, about nine of the 150” (F3), “not many, just seven from the 100...had no problems” (F6), “this was not a problem, only 17 of the 300 fish died” (F8), “we did not experience problems because (DOF extension agent) came to deliver the fish to us” (F9), “very few fish died from the transportation, this was not a problem” (F10), “just a few died, I am happy with last

year” (F11), “only 10 fish from the 250...from the heat” (F12), “just four fish from the 300 I bought...pond was near so I carried the plastic and walked there carefully” (F13), “...a few died from the 250. I transferred them using a vehicle, so this was not a problem” (F14), “only five of the fish died, this was very good” (F17), “only 10 died, this was not many, we were happy” (F18), “...few died, I was happy, others had many die” (F20), and lastly, “very few fish were lost. The ponds are close, there is a short time to be walking with the plastic” (F21).

The remaining six male farmers experienced a high mortality rate (F4, F5, F7, F15, F16, F19). These farmers reported ten percent or more of their fish died on the day the fish were stocked in the ponds. These farmers shared similar experiences such as, “lots of the fingerlings died, it was very difficult” (F4), “the first season, during transportation, not enough care was taken. Half of the fish in my pond died the first day” (F5), “about 20 of our fish died the day they were brought here” (F7), “70 to 80 died, maybe the distance to the pond, or the heat caused them to die, but I do not know” (F15), “17 of the fish died in the pond the first day” (F16), and “35 of the fish had died during stocking, out of 200 I purchased” (F19).

Research Question 8: Can you explain the challenges you faced in transporting the fingerling stock you received from the Zambian Department of Fisheries to your pond?

As was described in Objective One, the transportation of the fingerling stock to the village by the local Department of Fisheries vehicle was an improvement to the way in which the fish farmers previously acquired fingerlings. Of these 21 male fish farmers,

17 stated they did not experience any challenges with transporting their fingerling stock to their ponds (F1, F3, F4, F5, F6, F8, F9, F10, F11, F12, F13, F14, F16, F17, F19, F20, F21). “We used a bucket” (F1), “there were no challenges, the pond is very close, we carried the bags with our hands” (F3), “we carried them by their plastic, the pond is near” (F4), “this was not a challenge, my pond is near” (F5), “this was not a problem, the pond is close. We used our hands to carry the plastic to the pond” (F6), “when DOF brings the fish to the village, it is better. When we used to take from the government ponds, many more would die” (F8), “this was not a challenge, the pond is near. We transported the fish to the pond by bicycle and by vehicle” (F9), “we were carrying the plastic in our hands, we did not have a problem because the DOF extension agent brought the fish close to our home” (F10), “I carried them on my shoulder, inside the plastic. We went direct to the pond” (F11), “we did not open the plastic...carried the fish in a bucket and walked with them to the pond” (F12), “the pond is just one kilometer away, I put the fish in a basin and carried on my head. There were no problems” (F13), “DOF brought them near to my home, from the government ponds, so we did not have problems with transporting the fish” (F14), “after taking the fish from DOF in the village, I had to walk less than one kilometer, it was not a long distance to travel.” (F16), “we put the fish in a basin, we did not open the plastic...distance to the pond was only three kilometers” (F17), “I carried the fish by hand...this was not difficult as my pond is near to the village” (F19), “there were no problems. DOF brings the fish to the village and we are happy for that” (F20), and “we are happy to have DOF in our village, they

brought the fish and we did not have the challenge of traveling to the government ponds” (F21).

The remaining four male fish farming participants described experiences of dissatisfaction with the stocking procedures (F2, F7, F15, F18). These farmers had many challenges such as, “this year, the fish were gone before I could take any, other people took too many” (F2), “we had a problem with sharing the fish. We bought many with our neighbors but had to collect them from the ponds by hand...did not get a fair amount” (F7), “driving closer to the pond would be better, I want DOF to deliver the fish closer” (F15), and “the challenge is we do not know when DOF is arriving, We do not know, and people take our fish” (F18).

Research Question 9: In the past year, if the Department of Fisheries Extension service has been unable to provide you with fingerlings, have you found them available elsewhere?

Of the 21 male participants, 12 had never purchased fingerlings before the RAP program began in their village in 2013 (F1, F3, F4, F5, F6, F7, F10, F12, F14, F16, F20, F21). The farmers also responded they did not know of other places to purchase the fingerlings. The first time any of these 12 male participants purchased fingerlings was in 2014 with the order for the fish farming cooperative in the village. The responses from these first time fingerling buyers include, “I do not know of the other places to buy the fish. I have never bought them before” (F3), “no, this was my first time buying the fish” (F10), “I have never bought them before this program” (F12), “I have not taken fingerlings before this program” (F16), and “no, there are no other fish” (F21).

The remaining nine male fish farming participants reported on their experiences either purchasing fingerlings prior to 2014, or knowing where to purchase them (F2, F8, F9, F11, F13, F15, F17, F18, F19). “There are fingerlings in Nyanje, they are 50 ngwee each” (F2), “the fish are there in Nyanje, but it is far” (F8), “the first and second time I bought the fingerings, they were from DOF” (F9), “from government programs directly. But it is too far” (F11), “yes, at government ponds for the same price, but traveling to there and back with the fish is a challenge” (F13), “yes, some farmers keep the fingerlings in small ponds with water all year. I have bought the fingerlings like this before” (F15), “I have had to go to the government ponds myself” (F17), “I have bought them from the government ponds direct...” (F18), and “...I have only purchased from DOF” (F19).

Research Question 10: What type of financial support have you received in the past year, from the Zambian Department of Fisheries in Petauke District?

Of the 21 male participants, 13 reported receiving financial support from government programs (F1, F3, F4, F5, F6, F7, F9, F10, F12, F14, F16, F20, F21). Those 13 responded, “last year, I received half of my fingerlings for free, for being a fish farmer for the first time” (F1), “I received 50% for free from the government program” (F3), “first time, last year, I received the first time fish farmer discount” (F4), “the first season, in 2014, I was a fish farmer for the first time. Half of my fish were a gift” (F5), “first season, half of the fish were given for free to my family” (F6), “last year, half of the fish were for free, the other half were paid...” (F7), “last year, half of the fish were free from the government program for first time fish farmers” (F9), “my first time I was

given some fish for free because of government program” (F10), “last season I was given 50% for free with the government program” (F12), “I benefitted from the program for farmers who are fish farming for the first time, half of my fish were a gift” (F14), “I was given half of the fingerlings for free because I was a fish farmer for the first time” (F16), “half of my fish were given as a gift last year from the government” (F20), and “last year, 100 of my fish were for free because of being a fish farmer for the first time” (F21).

The remaining eight male participants reported not benefitting from any financial assistance from the government programs (F2, F8, F11, F13, F15, F17, F18, F19). This could have been due to not being a fish farmer for the first time, among other reasons. Some of those responses are listed as follows, “I never received help with the cost of fingerlings” (F2), “...there was no government program for me” (F8), “no financial support, I was not keeping fish for the first time” (F11), “I have not had free fingerlings from DOF” (F15), “I have always paid 50 ngwee per fish” (F17), “I did not receive free fingerlings” (F18), and “the first time I purchased from DOF was in 1994, the price was the same. I was never assisted from a government program” (F19).

Researcher’s Reflections

Upon reflection of the research interview responses, I repeatedly came across themes that were not previously anticipated in the creation of the research objectives. These are downstream results based on my observations that I was not searching for in my research questions. I observed these themes as having an effect on rejection in this

study. These include, water availability, predation, community/government support, and gender issues.

Water Availability

As mentioned previously, water availability was a major concern for farmers in the Munendwe community. Water sustains life not just for the farmers and their families, but also for their crops, cattle, livestock, and now fishponds. Rainy season can be unpredictable. Farmers have to prepare their fields at the essential time to correspond with the rainy season, all without access to a farming almanac or the Weather Channel. An added concern was now, when would the fishponds become filled with water? As described previously, farmers in this community relied on the rain to fill the earthen ponds, as rivers and lakes were not available for which to furrow water. It was important for farmers to arrange for the fingerling delivery soon after the rains had filled the ponds completely, to begin the growing process as fast as possible, because as soon as the rains stop, water evaporation will begin.

Throughout the interviews, it became apparent that the evaporation of water occurred rapidly. Because of this, many farmers attempted to keep the fish in the ponds longer than what was advised. When the water in a pond becomes very low, it becomes extremely vulnerable to predation. It was advised that farmers remove the fish by harvesting as soon as the water in the pond evaporated to 50% capacity. It had been said that this would more than likely not be until September or October as that is when other smaller natural bodies of water in the area typically became dry. Many of the ponds in Munendwe reached the 50% threshold in July.

Throughout the farmer interviews, many explained that they did not wish to “cut short” their fish-farming season by removing the fish prematurely, as they saw it. Unfortunately this led to an unexpected amount of loss due to predation. Many farmers, as listed previously, mentioned predation as a challenge during their interview.

Predation

Predation became a problem shortly after the ponds were stocked in February of 2014. Members of the fish farming cooperative and community were unaware of the complications predators would pose in the process of promoting fish farming. Prior to the discovery of this problem, predation was not a main concern for fish farmers. The main concern was always water availability, or concern for if the rains would be early or delayed, and whether or not farmers would have enough feed to provide to the fish. By late February, farmers began noticing fewer and fewer fish in the pond during their weekly or daily visits. Most common predators were presumed to be river otters, fish eagles, water monitors, and other assorted birds of prey indigenous to Eastern Province, Zambia.

It was at this time that I began compiling information about these predators to have suggestions for the farmers who sought my advice. By early March, I arranged with the fish farming cooperative committee chairperson to hold a meeting with fish farming members with the sole discussion topic of predation on the itinerary. At this meeting we discussed the types of predators afflicting the community, and ways in which farmers could protect themselves. The first suggestion included cutting grass very low around the perimeter of the pond, as well as inside the pond, for the purpose of exposing the

predators or their homes. Secondly, farmers were encouraged to visit their ponds at least once a day, preferably twice a day. It was explained that the common presence and scent of humans would deter predators. As a third suggestion, farmers were prompted to construct a log fence inside the pond for the purpose of creating a swimming obstacle for the water monitors and river otters. Lastly, farmers who had not already done so were encouraged to build a dense fence around the entrance and perimeter of the pond area to make accessing the pond on foot difficult and arduous.

Many months later, after harvesting occurred in July 2014, farmers reported to me socially, as well as in the interviews, they had found some success with these methods, although the majority acknowledged they had not chosen to implement these new techniques in the first fish farming season. However, after the second fish farming season transpired, during the 2-month time period in which the interviews were taking place, the majority of the fish farmers shared with me after experiencing predation as a major challenge to producing fish, they had plans to implement one or more of the techniques discussed in the meeting. I heard repeatedly from many fish farmers they had not previously implemented modern methods of deterring predators, but after experiencing one, and sometimes two seasons worth of predators stealing their fish, they were prepared to try new techniques in the upcoming fish farming season.

Upon reflection of the challenge predators caused the farmers and I, it was apparent that culture was a prominent factor in the rejection of fish farming innovations. Although the issue of predation became apparent rather quickly after the first fingerling stocking in February of 2014, and the issue was addressed with suggestions for deterring

the predators, farmers needed to experience these problems for themselves, sometimes repeatedly, before accepting suggested innovations.

Community Support

Prior to my Peace Corps service in Munendwe Village, I was informed the village had little contact with the local Department of Fisheries. A few farmers reported having spoken to the district extension agent previously, but most reported to me socially, that their first time having direct contact was during the arranged fish stocking in 2014. Participating farmers expressed gratitude for the new relationship with Department of Fisheries that developed because of the RAP program. I believe this relationship enhanced the program and inspired farmers to become involved, and stay involved in fish farming.

The visits from Department of Fisheries occurred approximately two or three times a year. In 2014, the district extension agent visited the Munendwe community on three occasions, the first in July of 2013 for a general meeting with myself to discuss fish farming prospects, the second in January 2014 to deliver the pre-ordered fingerlings, and the third visit occurred in June when the extension agent delivered the net allocated to the farmers for harvesting in July. In 2015, the district extension agent delivered fingerlings in early March, and is scheduled to assist with a fishing net again, sometime in the summer of 2015. The presence of a district extension agent in the village positively influenced and encouraged the fish farming cooperative members. Many fish farmers reported satisfaction with the support they had received from Department of Fisheries, and expressed their desire for the support to continue.

Gender Issues in Zambia

When discussing gender in relation to fish farming during participant interviews, it became a common theme for participants of both genders to become withdrawn, verbally and physically. Also important to note is the interpreter used for the interviews was male. The interpreter was a well known member of the community. He is a local headmaster of a government school who works very closely with occupants of Munendwe Village, and is also a member of the fish farming community. The interpreter had been a participant in the women's club for many years, facilitating meetings, and providing supplies and resources for income generating activities. It was my observation that members of the community and of the women's club, looked upon him quite favorably and was thus selected as the best option for the interpreter.

Male fish farming participants had little to say when prompted with questions about gender and women in Zambia. When interviewing participants, I would often follow-up the last two research questions, which asked about financial support from Department of Fisheries, how they felt about females receiving free fingerlings. There was only one instance in which I received a response that was longer than one or two words. Most of the male participants would answer that it was a good program, or respond that women should be supported. As the researcher, and as a Peace Corps Volunteer that had lived in the village for two years prior to the interviews, I did not feel these responses were genuine, and were more likely to be what the participants believed I wanted or expected to hear.

Prior to these interviews, I discussed sensitive topics with the female fish farmers who also happened to be members of the community women's club chapter. Discussions at these club meetings included topics such as HIV/AIDS, and use of contraceptives. In those meetings, I experienced an open dialogue with the women. It was common for club members to bring up sensitive topics and to ask questions. Because of these prior instances, it was intriguing to observe the difficulties women had when asked to describe their opinion of gender issues in Zambia. However, it is my personal reflection that female fish farming participants did have more to say than the male fish farming participants when prompted or asked about gender issues. Responses were notably limited and reserved, leading me to believe the answers were simply what they believed I wanted to hear as opposed to genuine, personal insight. It is possible that the male and female fish farmers were wary of discussing gender issues because either the topic was considered taboo and they intentionally avoided answering the question, or possibly the question was difficult to understand.

CHAPTER V

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Conclusions from Objective One

The first objective of this study sought to determine the potential factors that caused female fish farmers, in the village of Munendwe, to reject fish farming innovations introduced through the RAP program (2013-2015). The findings of Objective One indicate lack of labor, financial resources, access to fingerlings, and increased predation were the primary barriers affecting the rejection of innovations in fish farming in female participants. Complications with time management and transportation of fingerlings were reported as secondary barriers to adoption.

In this community, the labor of children is relied upon heavily as there is little to no assistance available outside the family unit. The family's maize, or corn, crop generates the highest income for rural farmers. Therefore, the maize fields often receive the majority of the time and labor available to a farmer. For most farmers, it is financially impossible to hire outside help to care for the pond. It is a traditional custom for the farming labor to be divided among able-bodied members of the family. The assistance of children was necessary due to lack of labor.

At the time of harvest, predators such as river otters, water monitors, and a variety of birds of prey were discovered to be the prominent cause for loss of fish in the ponds. River otters and water monitors often feed at night and in the early morning when farmers are occupied in their maize fields. Birds of prey will feed throughout the day and are difficult to deter. Some of these participants witnessed predation as it was occurring

in their fishponds, while others deduced predation was a factor due to sightings of predator tracks and or waste left behind.

The lack of access to resources such as fingerling stock was a prominent challenge for female farmers. Prior to the introduction and implementation of the RAP program, many of these participants reported having never purchased fingerling stock. These participants also acknowledged they did not currently know of any other available resources for procuring fingerling stock, other than the Department of Fisheries' government-run ponds. Access to fingerling stock is a necessity for successful fish farming practices.

As mentioned previously, in this rural farming community, the primary, income-generating crop is maize, followed by sunflower and groundnuts. The Federal Reserve Agency arrives once a year, with large flatbed trailers, to purchase this crop in bulk from farmers, and the money earned from this exchange is often used to purchase fertilizer for the next planting season. The amount of money earned for selling their maize crop is often too minimal to allow rural farmers to invest in new ventures such as fish farming. Lack of financial resources was a factor in the rejection of fish farming innovations.

Implications for Objective One

Labor

The lack of labor in regard to building and caring for fishponds was discussed frequently throughout the participant interviews. For fish farmers in Munendwe Village, the current options for utilizing outside labor resources involves hiring workers, which is a financial burden considered unavailable or unreasonable to most. The implications of

this study are congruent with the findings of Mwanja et al. (2007), which reported a significant limitation for their participating farmers was the reliance on family for labor, while the same family members were heavily invested elsewhere in manners of food production and income generation. Similarly, the findings of Harrison (2000), found that Zambian women faced great amounts of labor, which created a disadvantage in comparison to their male counterparts. The findings of the Zambian gender-focused study are reminiscent of the implications in this study. Rogers (2003) stated complexibility, the degree to which an individual believes the innovation will fit into the status quo of their routine, determines the adoption of the innovation. The findings of this study are comparable to Rogers' (2003), as the increased amount of labor required for fish farming increases the degree of complexibility. Previous literature has indicated the lack of labor input is a barrier to adoption.

Predation

Predation and loss of fish caused by pests such as river otters, water monitors, and birds of prey were determined to be factors affecting the rejection of fish farming. This construct parallels with the findings of Assefa, Van Den Berg, and Conlong (2008) whose study of sugarcane growers in Ethiopia reported pests such as stem borers were the most limiting factor in the farmers' production of sugarcane. Similar parallels are found in a study of the golden apple snail (GAS) in the Philippines. Joshi et al. (2001) reported the participating Filipino farmers perceived the GAS pest as their main cause for yield loss in their rice farming. In a Rwandan study of farmers' perceptions of production and productivity constraints, participants ranked pests as one of the top five

barriers to their production of sweet potatoes (Placide et al., 2015). The findings of the Rwandan study of farmers' perceptions are similar to the findings of this study. Previous literature has indicated uncontrolled predation and pests are barriers to the adoption of fish farming.

Fingerling Resources

In their study of resource-poor farmers in sub-Saharan Africa, Huis and Meerman (1997) reported a lack of access to agricultural inputs hinders farmer ability to reach maximum yield output. These findings are parallel to the implications of this study, which determined a lack of access to fingerling stock was a barrier to the farmers that sought to adopt innovations in fish farming. A second study whose findings were congruent to the implications of this study, conferred participating farmers suffered constraints to their fisheries production due to high costs and insufficient availability of agricultural inputs such as fingerlings (Peterson & Kalende, 2006). The implications of this study also correspond to the findings of Kelly et al. (2003), which determined increased costs of agricultural inputs, and inaccessible inputs, contributed to years of slow agricultural growth in sub-Saharan Africa.

Financial Resources

A lack of financial resources was determined to be a considerable challenge for the female fish farmers. In 2015, when the financial assistance program with the Department of Fisheries was no longer active, fewer women were able to purchase fingerling stock than in 2014. The implications of this study are congruent with the findings of Kalinda et al. (1998), whose study recognized a barrier to increased

productivity in small-scale rural farmers was a lack of access to credit and loan programs. The findings of Vetrivel and Selvi (2012), in their study of the Indian economy, described access to credit as an essential input for farmers, allowing farmers the ability to take on new investments and adopt new technologies. The findings of Vetrivel and Selvi are parallel to the implications found in this study. Lastly, this study's implications correspond with Rogers' (2003) findings of perceived attributes of an innovation. Rogers (2003) stated relative advantage represents the extent to which an adopter believes an innovation to be better than the previous innovation or method. In this case, farmers were not convinced that using their money to invest in fish farming was a better use of their income.

Objective One Recommendations to Future Researchers

A study of farmers' perceptions of agricultural cooperatives with a focus on specific examples of successes and failures could lead to information used for encouraging adoption of this model of shared labor in other rural communities. A study of this nature would create an opportunity for farmers to understand the relative advantage of cooperatives. A study focused on determining different methods of utilizing agricultural cooperatives in other Zambian communities or sub-Saharan countries would lead practitioners to examples of how to incorporate cooperatives into their trainings. Lastly, future study is needed on gender roles, particularly those of Zambian women and the work they contribute to agricultural and farming in their communities. With a better understanding of farmers' perceptions of labor divides in

regard to gender, practitioners have an advantage in encouraging the adoption of fish farming innovations.

Zambian farmers and practitioners would gain desperately needed information on how to protect their ponds from predators if research was conducted on this topic. A study focused on unveiling the most common types of predators and the damage they cause in rural Zambian farming communities or, a study focused on farmers' traditional methods of deterring predators, would be greatly advantageous to practitioners across the country.

Research conducted on fingerlings and hatchery systems would be greatly advantageous to farmers in a rural Zambian community. A study focused on methods to improve fingerling stock procurement by rural fish farmers could enhance the limited knowledge farmers currently have of their access to resources. Secondly, a research study on the successes of village-level hatchery systems or brooding ponds could add valuable information to the limited body of knowledge currently known about these types of fish farming practices. Improved knowledge supports practitioners such as Peace Corps staff and Peace Corps Volunteers to develop better, more relevant training materials for farmers.

Future researchers can study the successes and failures of varying micro-finance and micro-credit programs in Zambia and other sub-Saharan countries in Africa. Information obtained from this research could be applied to farmer trainings and seminars facilitated by Peace Corps Volunteers or Peace Corps staff, allowing these groups to incorporate this information into fish farming enterprises. A focus on

government spending in agriculture and resources provided by Zambian government departments or ministries would greatly benefit Peace Corps Volunteers and Zambian farmers by adding to the currently limited body of knowledge.

Objective One Recommendations to Practitioners

In the case of this study, a practitioner would be considered future Peace Corps Volunteers, as well as Peace Corps staff. A future Peace Corps Volunteer could increase the rate of adoption of innovations in fish farming by focusing on the barriers described in this research, lack of labor, predation, and the lack of resources in fingerlings and financial resources.

A particular recommendation directed at Peace Corps staff is the encouragement of a mentoring-type relationship between a departing Peace Corps Volunteer and an incoming Peace Corps Volunteer. Currently, there is no value placed on the importance of a comprehensive “hand-off” for PCVs replacing another Volunteer’s specific site. The exchange of information about 27 months of project successes and failures, and introductions to community opinion leaders is exceptionally important. Authorizing the time it takes to complete this hand-off will allow the incoming Peace Corps Volunteer to decrease the amount of time it would take them to learn these things organically and on their own.

A resurgence of interest and participation in the community’s fish farming cooperative could provide direction in how to organize labor assistance to its members. Khumalo maintained cooperatives are the most common method utilized around the world to encourage improvements in the subsistence and livelihoods of those in need

(2014). Membership in the Munendwe fish farming cooperative began in anticipation of the arrival of the researcher and Peace Corps Volunteer for the purpose of organizing a group of people interested in participating in the RAP program. At the start of the RAP program, organized labor sharing was recognized among members as an advantageous method of building and maintaining fishponds, however this practice never came into fruition.

There are several fencing techniques that exist to keep predators out and away from the pond. Some of these techniques involve introducing fencing materials into the actual pond itself. Often, these techniques do not involve any outside materials, and can easily be found within a garden. These materials typically include thorny brush vegetation and fencing posts cut from tree trunks. Fences can be built around the outside perimeter of a pond to keep water monitors and otters from entering, and fences inside the pond can cause birds of prey to be unable to remove the fish from the pond. Theft by humans can also be considered a form of predation, and has been experienced in this community. Some farmers will post family members as guards at their fishpond, while others string lines of barbed wire throughout the pond, underneath the water, to cause tears in fishing lines or nets used by potential thieves.

A practitioner, a Peace Corps Volunteer in this case, could address the lack of fingerling resources by encouraging improved participation in the community fish-farming cooperative. This, along with a Peace Corps training on brooding and hatchery ponds, would encourage farmers to attempt keeping fingerling stock year round, which in turn, would offer more options for purchasing fingerlings in the village. The

establishment of a village hatchery system and the practice of caring for fingerling stock throughout the dry season would allow for fish farmers to be self-reliant in procuring fingerling stock for their fishponds (Jaspe & Caipang, 2011). Brooding ponds are smaller than full-size ponds built for the purpose of keeping fingerling stock alive until the next stocking period. In rural settings, and particularly in Zambia, a brooding pond would typically be located in an area with high groundwater, allowing for minimal water loss due to evaporation. Mwanja et al. (2007) encouraged the support of developing private fish seed suppliers as access to government fingerling supply centers was unreliable and fish stock was not found to have quality-control standards.

To address the lack of financial resources, it would be advantageous to practitioners to find examples of other fish farming cooperatives and communities that used savings programs or micro-loans to support fish farming enterprises in Zambia or sub-Saharan Africa. This would encourage adoption based on Rogers' (2003) theory of relative advantage. Community members would have a better opportunity to determine for themselves if the idea of saving and spending their money differently, to support fish farming, is better for them than their previous financial habits.

Conclusions from Objective Two

The second objective of this study sought to determine the factors leading active male fish farmers to reject innovations in fish farming introduced through the RAP program (2013-2015) in their community. The findings of objective two indicate lack of resources in regard to harvesting, fingerlings, and money were the primary barriers affecting the rejection of innovations in fish farming in male participants. Lack of labor,

increased predation, and culture were determined to be secondary barriers to adoption of fish farming.

This study's data found the primary barriers to adopting fish farming had significant overlap between the female participants in Objective One and the male participants in Objective Two. Both groups of participants reported the barriers of lack of financial resources and lack of fingerling resources. However, additionally, the male fish farming participants added lack of harvesting resources as a primary detractor from adopting fish farming innovations. A higher percentage of men discussed the difficulties they experienced with catching and harvesting their fish. The lack of useful harvesting tools caused farmers to have overpopulated ponds, which led to increased predation and an ultimately unhealthy pond. It is also important to note, the farmers that reported hiring outside labor, were the same farmers that reported having little to no challenges with predation in their ponds. These farmers did not have the need to continue attending RAP trainings or farmer cooperative meetings, as they had reached the innovator stage of the innovation adoption lifecycle (Rogers, 2003).

Peace Corps Volunteers act as change agents in every aspect of their job. Rogers (2003) defined a change agent as an individual who is typically seeking to influence or assist potential adopters in embracing an innovation. The data gathered throughout this research study affects these change agents. The aspects of adopting fish farming innovations that are determined the most challenging, and are blamed for rejection, are the aspects needing the most attention and consideration by change agents in the

community. This data provides an outline for change agents to effectively generate change in the rates of adoption.

Implications for Objective Two

Fingerling and Harvesting Resources

The implications for Objective Two are parallel with those of Objective One. The implications for both the female and male participants are congruent with the findings of previous literature, which indicated a lack of access to agricultural inputs, such as fingerlings and harvesting tools, were barriers to the adoption of fish farming.

Financial Resources

The data obtained from the 21 male fish farming participants was similar to the data obtained from the female fish farming participants. A lack of financial resources was a determined challenge between both genders. The implications for Objective Two are consistent with those of Objective One.

Heterophily

The data from this research indicated the participants most likely to be active in the fish farming program, and most willing to consider adopting new practices, were the older farmers. The researcher conducting this study is heterophilic in age from these early adopters. This data implies a lack of congruency from that of Rogers' (2003) findings in regard to homophily, the degree to which two communicating individuals is similar. Rogers (2003) stated there is a lack of consistency in evidence that proves there is a relationship between age and innovativeness, but reported a homophilous relationship is more likely to stimulate and encourage the diffusion process.

Objective Two Recommendations to Future Researchers

Recommendations for future researchers in regard to investigating fingerling and harvesting resources are similar to that of Objective Two. A study centered on the successes of fingerling and hatchery systems from other parts of the world would be greatly advantageous to farmers. Rural farmers often lack the ability to acquire useful knowledge from other developing communities across the globe. A study of this nature would support practitioners such as Peace Corps staff and Peace Corps Volunteers to develop better, and more relevant trainings for farmers.

Future researchers are behooved to study the successes and failures of varying micro-loan and credit programs that are available to Zambians. Information obtained from this research could be applied to farmer trainings and seminars facilitated by practitioners. A focus on government spending in agricultural resources provided by Zambian government departments would greatly benefit Peace Corps Volunteers and Zambian farmers by adding to their currently limited body of knowledge on this topic.

Future research focused on studying the specific role of change agents in rural Zambian communities or the effectiveness of past change agents in other agricultural development programs would be valuable for current and future Peace Corps Volunteers. The data from this study displayed discontinuance in rural fish farmers. Future research conducted on the relationship between rejection of innovations and change agents could produce information helpful in the prevention of discontinuance.

Objective Two Recommendations to Practitioners

As with the recommendations to future researchers in Objective One, the formation of a hatchery system or brooding pond in the village would allow for fish farmers to be self-reliant in obtaining fingerling stock for their fishponds. A brooding pond cared for and utilized by the community could create a situation in which minor input for each individual farmer could result in a major increase in available agricultural input for the entire community. In conjunction, encouraging fish farmers in the community to come together for the purchase or procurement of one fishing net available to the entire community could address the barrier of lack of harvesting resources and tools. Also, a loan program focused on the investment of a community fishing net would be a solution worthy of investigation.

Finally, practitioners are recommended to find examples of other developing fish farming cooperatives and communities that used savings programs. This would encourage adoption based on Rogers' (2003) theory of relative advantage, which states adoption is unlikely to occur if a potential adopter is unable to decide if the new innovation is worthy of replacing the last.

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APPENDIX A

INTERVIEW QUESTIONS

The following is a list of questions asked during the interview:

1. What kind of physical labor did you receive with caring for your fish pond(s) this year, specifically from the people in your household?
2. What is an example of a challenge you faced in harvesting the fish pond(s)?
3. Did any members of the community help you with the physical labor of digging your fish pond(s)?
4. How did you include fish farming in your seasonal farming calendar this year?
5. What new techniques did you implement in the way you cared for your fingerling stock this season?
6. If you did not implement new techniques, why not?
7. What kind of mortality rate did you experience during your transportation of fingerling stock from the village to your pond?
8. Can you explain the challenges you faced in transporting the fingerling stock you received from the Zambian Department of Fisheries to your pond?
9. In the past year, if the Department of Fisheries Extension service has been unable to provide you with fingerlings, have you found them available elsewhere?
10. What type of financial support have you received in the past year, from the Zambian Department of Fisheries in Petauke District?

APPENDIX B

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM INFORMATION SHEET

Protocol Title: “Factors Determining the Rejection of Fish Farming Innovations in a Rural Zambian Community”

Please read this consent document carefully before you decide to participate in this study.

Purpose of the research study:

The purpose of this research is to identify and describe the factors that effect the rejection of fish farming innovations in rural Zambian farmers. The availability of this research to PCV trainees, current PCVs, and for extensions agents at the Zambian Department of Fisheries, will allow for a better understanding of certain influences that contribute to the rejection of innovations in fish farming. This increases volunteers’ capacity to work more efficiently and effectively in the given 24 months of service at their community post.

What you will be asked to do in the study:

You will be asked to do the following:

1. Identify a time and place in which you would prefer to participate in an interview
2. Participate in an interview about your experiences in fish farming during the years of 2013-2015

Time required:

In reference to the actives numbered above:

1. 10 minutes
2. 1 hour

Risks and Benefits:

There are no risks or benefits for participants in this study. The things that you will be doing are no more risk than you would come across in everyday life.

Compensation:

There will be no compensation for participating in this research.

Confidentiality:

Your identity will be kept completely confidential throughout this study. Your information will not be used in any report. Information about you will be kept confidential to the extent permitted or required by law. People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects

Protection Program may access your record to make sure the study is being run correctly and that information is collected properly.

Voluntary participation:

Your participation in this study is completely voluntary, and there is no penalty for non-participation.

Right to withdraw from the study:

You have the right to withdraw from this study at any time with no consequence.

Whom to contact if you have questions about the study:

Holly Van Groll, Peace Corps Volunteer, PO Box 580075 Sinda District, Eastern Province, Zambia. +26-0969517548

Whom to contact about your rights as a research participant in the study:

For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at +1-855-795-8636 or irb@tamu.edu.

APPENDIX C

DIVISION OF RESEARCH

Research Compliance and Biosafety



DATE: April 20, 2015

MEMORANDUM

TO: Robert Strong Jr
ALRSRCH - Agrilife Research - Ag Leadership, Education & Communication

FROM: Dr. James Fluckey
Chair
Institutional Review Board

SUBJECT: Expedited Approval

Study Number: IRB2015-0170D
Title: Factors Determining the Rejection of Modern Methods of Aquaculture in a Rural Zambian Community
Approval Date: 04/20/2015
Continuing Review Due: 03/15/2016
Expiration Date: 04/15/2016

Documents Reviewed and Approved:

| Submission Components | | | |
|--------------------------------|----------------|--------------|----------|
| Study Document | | | |
| Title | Version Number | Version Date | Outcome |
| Translation_InterviewQuestions | Version 1.0 | 04/14/2015 | Approved |
| Translation_InformationSheet | Version 1.0 | 04/14/2015 | Approved |
| Site Authorization Form | Version 1.0 | null | Approved |
| Study Proposal | Version 1.0 | null | Approved |
| Letter of Cultural Evaluation | Version 1.0 | null | Approved |
| Information Sheet | Version 1.1 | 04/10/2015 | Approved |

Document of Consent: Waiver approved under 45 CFR 46.117 (c) 1 or 2/ 21 CFR 56.109 (c)1

Comments: This study has been approved.

This research project has been approved. As principal investigator, you assume the following responsibilities:

1. **Continuing Review:** The protocol must be renewed by the expiration date in order to continue with the research project. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study termination, and/or

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