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THE ROLE OF PARTICIPATORY MONITORING AND EVALUATION FOR SUSTAINABLE BACKYARD AQUACULTURE

(A SURVEY OF FISH PROJECTS IN KIKUYU, LARI AND GITHUNGURI)

BY

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DECLARATION

This Project is my original work and has not been presented for a Degree in Any other university or for any other award.

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DEDICATION

This work is dedicated to my husband Patrick who inadvertently drew my curiosity to explore possible challenges to sustainable pond aquaculture in fish production when he was engaged in the oversight of one such project in 2009.

ACKNOWLEDGEMENT

I acknowledge with heartfelt gratitude, first, to the Almighty God who has enabled me to go through this work successfully. Second, to my distinguished supervisors Mr. Paul Sang and Ms. Rosemary James, who have patiently and deftly, imparted their intellectual wealth and expertise to mould my effort into acceptable academic substance; and to my beloved family, husband Patrick, son Jeremiah and daughter Faith for their encouragement and gracious acceptance of the long hours spent away from them as I undertook this work; not forgetting my dear sister Anne for her prayers and support in every way. May the Lord God richly reward each and every one of you.

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LIST OF ABBREVIATIONS AND ACRONYMS

AC: Actual Cost

ANOVA: Analysis of Variance

CDF: Constituency Development Fund

CPI: Cost Performance Index

CSF: Critical Success Factors

C/SCSC: Cost/ Schedule Control System Criteria

DLP: Department of Livestock Production

DOF: Department of Fisheries

DFO: District Fisheries Officer

EAC: East African Community

ERPARDP: Economic Recovery Poverty Alleviation and Regional Development Programme

ERS: Economic Recovery Strategy

ESP: Economic Stimulus Package

EV: Earned Value

EVMS: Earned Value Management System

FAO: Food and Agricultural Organization

FDI: Foreign Direct Investment

FFEPP: The Fish Farming Enterprise Productivity Programme

GDP: Gross Domestic Product

iNGOs: International Non Governmental Organizations

KRA: Key result Areas

MCDA: Multi-Criteria Decision Analysis

MDG: Millennium Development Goals

MNC: Multi-National Corporations

MOLD: Ministry of Livestock Development

MOFD: Ministry of Fisheries Development

MOPND: Ministry of Planning and National Development

MT: Metric Tons

PCTS: Performance, Cost, Time, Scope

PH-Check: Project Health-Check

PMCC: Pearson Multi-Product Correlation Coefficient

PM&E: Participatory Monitoring and Evaluation

PV: Planned Value

R&D: Research and Development

SPI: Schedule Performance Index

TQM: Total Quality Management

WSM: Weighted Sum Model

OPERATIONAL DEFINITION OF TERMS

Monitoring: This is the systematic collection and analysis of information about project performance as a project progresses.

PM&E: The practice by farmers to record, monitor and evaluate performance of their fish pond projects for reference by other relevant stakeholders.

Project Sustainability: Ability of a project to continue to generate capital outflows that will sustain it and yield profits for the farmer after the initial outlay has been recovered. The focus of this study was biased towards economic sustainability.

Aquaculture: This is the practice of growing plants and animals on/in water. The focus of this study was fish production using fish ponds.

Project Control: Appropriate measures undertaken by the farmer to adhere to the technical guidelines of project implementation and keep within the expected budgetary limits.

Project Success: The measure of project performance in terms of profitability, over and above the break-even point.

Project Output: The immediate tangible results that can be verified as the project progresses. In this study it is the fish harvested from the pond.

Project Quality: The measure of compliance by the farmer to the technical guidelines of project implementation.

Cost Performance: The measure of the actual cost relative to the expected (planned) cost.

Schedule Performance: The measure of timeliness in attainment of project milestones.

Project Manager: The project participant executing project activities on the farm.

Backyard/Pond Aquaculture: Fish farming.

ABSTRACT

The Government initiative to expedite commercial aquaculture through the Economic Stimulus Programme (ESP) fishpond projects since 2008 has had resounding success, based on the demand for these projects by prospective farmers. A total of 20,000 fish ponds have been constructed across 140 constituencies (Muiruri, 2010). Aquaculture production went up by almost 250% between 2009 and 2010 but the fish prices increased by 27.6% in the same period (Economic Survey, 2011). How sustainable are these projects? This study investigated how pond fish farmers in Kiambu County undertake PM&E of their projects and how this influences economic sustainability. PM&E was divided into Project Success and Project Control variables. The study examined how Project Control and Project Success variables relate; and also influence sustainability. Three purposive samples each of 34 respondents, based on project location (Kikuyu, Lari and Githunguri) were targeted by the study. Data was elicited through examination of an interview survey of one hundred and two (102) Economic Stimulus Package (ESP) beneficiaries in Kikuyu, Lari and Githunguri districts. Secondary observation was also done to verify the status of record-keeping as an indicator that PM&E is undertaken by the respondents. Descriptive statistics was used to analyze the baseline characteristics of the project. Correlation analysis was done to investigate whether the Project Control and Project Success variables co-vary in the study, and to quantify the strength of the linear relationship between the two. Inferential analysis was undertaken to show whether project location and intervening variables were significant to project sustainability. The Multi-Criteria Decision Analysis (MCDA) approach using the Weighted-Sum Model (WSM) of the maximization case method was used to analyze the relative degree of PM&E undertaken by respective project locations and the consequent effect on project sustainability. Results showed the existence of emerging systems of integrated fish farming, not conforming to the project implementation guidelines. These are innovations by farmers endeavouring to enhance project sustainability; and, 66% of the projects targeted in the study were operating at a level that can be economically sustainable. Kikuyu was found to perform best in this respect followed by Githunguri and Lari in that order. Lack of fishing nets hampered frequency of harvests as farmers in the each district share one net. The study concludes that PM&E through accessible record keeping, as well as pond security, are significant to the economic sustainability of the projects. Also, innovations in project implementation enhance project sustainability. Both aspects are illustrated by the results of Kikuyu. The study recommends that government policy should come up with a system that will motivate farmers to keep records in forms that can be accessed years on in the life of a project if its sustainability is to be monitored and evaluated. It also recommends that collaborative efforts between government and other stakeholders in the private sector can consolidate efforts in the areas of community mobilization, consistent farmer training, extension services, credit facilities, provision of affordable fishing equipment, processing and marketing. Project sustainability is more complex than economic sustainability alone. Further research would take one or more of these aspects to explore such as political, socio-cultural, technological, environmental, demographic and legal sustainability.

CHAPTER ONE: INTRODUCTION

1. Introduction

The Chapter presents the background of the study; statement of the problem; research objectives; research questions, significance and scope of the study; limitations and assumptions of the study.

1.1 Background of the Study

Commercial aquaculture is important at all levels of the economy. It is a source of food and nutrition security at domestic level (MOLFD), 2004-2008; MDG 1, 2000); serves as a vehicle to provide employment opportunities, income generation and wealth creation at commercial and industrial level; and can provide raw material for the industrial sector to process and export in order to earn the country much needed foreign exchange (Ministry of Planning and National Development (MOPND), 2003). Economic sustainability of the aquaculture projects is therefore critical to the very existence of the sub-sector which is core to livelihoods at various levels of the economy.

The purpose of engaging in commercial aquaculture is to realize continuous income generation to sustain the livelihoods of the communities concerned. This implies that commercial aquaculture must be undertaken as a sustainable project to ensure that it serves its purpose. Project sustainability depends on how much the project manager is in control of project activities in order to maximize lasting profitability. This can only be possible if the project manager is engaged in consistent Participatory Monitoring and Evaluation (PM&E) of his or her project, with relevant stakeholders. Project Monitoring & Evaluation (PM&E) gives the project manager control by revealing where appropriate measures need to be undertaken to keep the project on track.

Global studies in Project Monitoring & Evaluation (PM&E) have ranged from discussing the difficulty in controlling a complex project caused by the great number of performance indicators in Toulouse, France (Matthieu & Didier, 2010) to characteristic differences in the implementation of PM&E between the Dutch and French (de Bony, 2010). That notwithstanding, von Bertrab and Zambrano (2010) in their study of a real project management situation for a wetland restoration project in Mexico observed that; PM&E provided a basis for understanding local livelihood strategies and stakeholder priorities and found that recognizing the differences among stakeholders and establishing institutional arrangements that account for these differences resulted in more inclusive projects based on mutual understanding and cooperation, and this in turn, yielded better results. However, they also found that group dynamics, local political alliances, and powerful actors could turn participation into an intricate social process. They concluded that restoration practitioners who are serious about participation should bear in mind that a participatory approach may add complexity to project implementation, but the outcome may be more sustainable restoration projects.

Regionally, a study done in Uganda by Parkinson (2009) found that there exists a mismatch between programme assumptions and participant perceptions, which stymied the implementation of PM&E within development programmes. In north-western Tanzania, a study undertaken by Silva and Kepe (2010) to examine 'participation' and 'sustainability' in a Food Security project among the rural poor concluded that there is a growing segment of the poor who face too many constraints to participate, become 'empowered' as well as advance the well intentioned goals of the community development projects. And in Nigeria, Ogunlade (2007) found in his study on socio-

economic characteristics of backyard fish farmers in Osun, that importance and difficulties of management practices did not necessarily include PM&E. These studies indicate that appropriation of PM&E can be highly subjective based on the perception of the programme participants.

In Kenya, related empirical studies include Kahindi et. al (2010) who employed a participatory survey to monitor the illegal killing of elephants across diverse land uses in Laikipia-Samburu, in northern Kenya, elephant mortality data were collected using both standard law enforcement monitoring procedures, relying on patrolling, and participatory methods involving local communities. Qualitatively, traditional patrolling techniques were more successful in protected areas whereas participatory approaches provided more information outside protected areas, where elephant were most at risk from ivory poachers.

In another study, Roba & Oba, (2009) engaged pastoralists to undertake community participatory landscape classification and biodiversity assessment and monitoring of grazing lands in northern Kenya. In this study, they asked the Ariaal herders of northern Kenya to answer "why, what and how" they classified landscape, and assessed and monitored the biodiversity of 10km² of grazing land.

To answer the "why question" the herders classified grazing resources into 39 landscape patches grouped into six landscape types and classified soil as 'warm', 'intermediate' or 'cold' for the purpose of land use. For the "what question" the herders used soil conditions and vegetation characteristics to assess biodiversity. Plant species were described as 'increasers', 'decreasers' or 'stable'. The decreaser species were mostly grasses and forbs preferred for cattle and sheep grazing and the increasers were mostly

woody species preferred by goats. The herders evaluated biodiversity in terms of key forage species and used absence or presence of the preferred species from individual landscapes for monitoring change in biodiversity.

For the "how question" the herders used anthropogenic indicators concerned with livestock management for assessing landscape potential and suitability for grazing. The anthropogenic indicators were related to soils and biodiversity. The herders used plant species grazing preferences to determine the links between livestock production and biodiversity. By addressing these three questions, the study shows the value of incorporating the indigenous knowledge of herders into classification of landscape and assessment and monitoring of biodiversity in the grazing lands. We conclude that herder knowledge of biodiversity is related to the use as opposed to exclusive conservation practices. This type of knowledge is extremely valuable to conservation agencies for establishing a baseline for monitoring changes in biodiversity in the future.

The two studies are examples of participatory monitoring surveys (Kahindi et. al.) and evaluating surveys (Roba & Oba, 2009) respectively, in which researchers have engaged the communities on the ground to get involved at the secondary level.

1.1.1 The Fish Farming Enterprise Productivity Programme (FFEPP)

The first phase of the Fish Enterprise Productivity Programme (FFEPP) was initiated in 2008/2009 and ended in the 2009/2010 fiscal year. The programme, currently in its second phase, is implemented under the Economic Recovery Poverty Alleviation and Regional Development Programme (ERPARDP) funded by the Government of Kenya under the Economic Stimulus Programme (ESP). In 2008/2009 the Government of Kenya

initiated the FFEPP to kick start the economy which was then reeling from the after effects of the post election unrest as well as the global financial crisis. In 2008/2009, the government through the Ministry of Fisheries Development (MOFD) adopted a strategy to expedite commercial aquaculture growth though the ESP. By the end of the 2009/2010 fiscal year, a total of 20,000 fish ponds had been constructed across 140 constituencies (Muiruri, 2010; KNBS, 2011).

Phase II of the project is expected to be implemented within the 2010/2011 fiscal year. In this phase, the MOFD will construct 100 fish ponds per constituency in the 140 constituencies that benefited during phase I of the project and 300 fish ponds in 20 new constituencies (Implementation Guidelines for FFEPP, 2010/2011). Project initiation is done on a cost sharing basis where the government covers the cost of digging the fish pond while the farmer bears the remaining project cost. Commercial aquaculture demands that the fish projects remain profitable and sustainable in order to serve effectively as a source of livelihood for the fish farmers.

Commercial aquaculture comprises of a sequence of project activities which culminate in fish production for sale to alleviate poverty. It must be executed as a project if is to serve the purpose of generating positive cash outflows needed to sustain livelihoods. Having definite start and finish project milestones, it is expected that commercial aquaculture delivers the project benefits within acceptable budgetary provision and time frame; and of the expected quality. Furthermore, these project benefits should be continuous since they must sustain livelihoods through the income so generated. That is why economic sustainability of the fish projects is fundamental to commercial aquaculture.

1.2 Statement of the Problem

The Government initiative to expedite commercial aquaculture through the Economic Stimulus Programme (ESP) fish pond projects since 2008 has had resounding success, judging by the demand for entry into these projects by prospective farmers according to Muiruri (2010). According to the Economic Survey (2011), a total of 20,000 fish ponds have been constructed across 140 constituencies between 2009 and 2010. Aquaculture production went up by almost 250% in the same period, supplying 12.2 thousand metric tons of fish into the domestic market. This additional supply however, did not bring down or stabilize fish prices on the local market but the price went up by 27.6% in the same period. Since 2006 before the FFEPP was launched, to date, both aquaculture production and fish prices have continued to increase steadily (Economic, Survey 2011). This is contrary to expectations because increase in supply should bring about a reduction or stabilizing effect on the price. What impact have these projects had on the supply of fish to the domestic market?

The FFEPP is designed in such a way that the government funds the initial cost of project implementation through pond construction. Thereafter, the farmer bears financial responsibility for entire project, which is expected to continue to generate capital that will sustain the project and provide income for the farmer through the sale of the fish that is harvested from the ponds after the government pulls out, financially. Economic sustainability is therefore crucial for the projects.

A study done by von Bertrab and Zambrano (2010) on the restoration of a wetland project in Mexico observed that PM&E provided a basis for understanding local livelihood strategies and stakeholder priorities and concluded that restoration practitioners who are serious about participation should bear in mind that a participatory

approach (of which PM&E is part), may add complexity to project implementation, but the outcome may be more sustainable restoration projects.

The purpose of this study therefore, was to examine how PM&E is undertaken by pond fish producers in Kiambu County and how this affected the performance and hence, the economic sustainability of the corresponding fish projects.

1.3 Objective of the study

The general objective of the study is to examine the role of PM&E in project sustainability. The specific objectives to the study are:

I. To determine how project quality influences project sustainability in pond aquaculture.

II. To find out how the average project cost incurred by the project manager influences project sustainability in pond aquaculture.

III. To examine how schedule performance influences sustainability of the fish pond projects.

IV. To find out how project output influences the sustainability of fish pond projects.

1.4 Research Questions

I. How does farmer's adherence to operational compliance (project quality) influence project sustainability?

II. How does the average project cost influence project sustainability?

III. How does the degree of project timeliness influence project sustainability?

IV. How does project output influence project sustainability?

1.5 Significance of the Study

According to Heck, Bene, and Reyes-Gaskin (2007) and the Economic Survey (2011), Kenya can realize social and economic benefits enormous from a thriving aquaculture sub-sector are enormous but Kenya has exploited only 0.04% of available potential for aquaculture production (MOFD Strategic Plan, 2008-2012) and "the fisheries sector has been too narrowly concerned with sector-internal objectives, at the expense of wider social and human development benefits..." The Government's policy for fisheries sub-sector has been to maximize production by proper utilization of resources (MOFD Strategic Plan, 2008-2012). That means the social and economic benefits at the primary, secondary and tertiary level, Kenya can realize from a thriving aquaculture sub-sector can be projected to increase by a staggering 2,500 times.

At the primary (farm) level, food and nutrition security, especially protein, would be achieved in the general population. At the secondary level, investment opportunities in all related sectors would increase tremendously, to provide infrastructure for distribution, storage and marketing of the fish, boosting the general physical infrastructure like the road network in rural areas, running water and electricity and triggering development in other sectors of the economy. At the tertiary level, more investment opportunities in the industrial sector would be realized through processing the fish products and by-products, both for domestic and export market, to earn the country the much needed foreign exchange. PM&E would reveal the level at which the sub-sector is performing relative to the full potential, and which areas of the project need to be improved in order to bridge this gap

The stakeholders that are likely to benefit from the outcome of this study are partners in Research and Development, such as the government, researchers, service providers, input

suppliers; potential and practicing fish farmers at the primary level, transporters at the secondary level; processors and exporters at the tertiary level for sector-wide development.

The government will use the outcome of the study to formulate and review new and existing policies and legislation to enhance development of the aquaculture sub-sector. Researchers will seek to explore why PM&E is undertaken differently by various project participants. They can also explore through further research, which other factors can be aggregated to form PM&E and what other tools and techniques to use in analysis PM&E.

Technical extension service providers will use the outcome of the study to design specific extension packages, approaches and training that can influence behavioral change that will determine how PM&E is applied. Marketing service providers will use the results of the study to appraise whether or how they can organize the fish farmers into groups to enhance marketing, and also source for other markets for the farmers. Industrialists will base their investment decisions on the performance value of project output.

Input suppliers can use the results to decide on what substitutes they can offer in order enhance production or reduce the cost of production. Potential and practicing farmers will use the results to influence their decisions on how to control their projects by improving their performance value for PM&E in order to guarantee sustainability of their projects.

1.6 Scope of the study

This study covered small scale fish farmers in Kiambu County, who have at least one standard size (300 square metres) fish ponds in their fish project. They had harvested at

least once prior to the time of data collection. The focus was beneficiaries of the Economic Stimulus Package in Kikuyu, Lari and Githunguri districts in Kiambu County.

1.7 Limitations of the study

The accuracy and reliability of the data may not have been optimal. This depended on the extent to which respondents gave truthful answers and the reliability coefficient of the psychometric instrument that was used. Using Kunder-Richardson's (KR_{20}) formula, the Cronbach's Alpha statistic which is the reliability coefficient has a value of 0.536. Though some professionals insist on a reliability score of 0.70 or higher in order to use a psychometric instrument, this rule, according to Choudhury (2010), should be applied with caution when α has been computed from items that are not correlated. The resources to undertake the survey were also limiting. The researcher, in piloting the psychometric instrument sought to enhance its accuracy and employed a highly structured methodology to facilitate replication, an important issue to ensure reliability. (Saunders et al, 2007). To minimize the weakness of subjectivity and bias of the researcher during analysis, the researcher had two analysts to code the transcript independently and compare notes.

1.8 Assumptions of the study

The study assumed that the respondents would be willing to answer the questions on the interview schedule. Another assumption is that the answers that the respondents give would be truthful. The study also assumed that the respondents are undertaking the projects as a commercial enterprise; that there is sufficient demand to support the fish projects; that there is consistent supply of fingerlings at all times to enhance timely stocking and restocking of the fish ponds; that every farmer has access to the market and that every farmer is exposed to technical advisory services given by government extension service.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter contains reviews of the theories which act as the foundation of the proposed study as well as empirical literature (practically done studies) conducted by other researchers. It also consists of the research gaps and the conceptual framework of the study.

2.2 Theoretical Review

2.2.1 Assigning project Constraints

Lewis (2007) in his book entitled 'Fundamentals of Project Management' states that one of the commonest causes of project failures is that the project sponsor demands that the project manager must finish the job by a certain time, within a certain budget, at a given magnitude or scope, while achieving specific performance levels. In other words, the sponsor dictates all four of the project constraints. This doesn't work. The relationship between the PCTS (Performance, Cost, Time, Scope) constraints can be written as follows:

$$C = f(P, T, S)$$

In words, this says, "Cost is a function of Performance, Time and Scope. Graphically, Lewis shows it as a triangle in which P, C and T are sides and S is the area. In geometry we can calculate the area of a triangle if we are given values of the sides; or if we are given the area and two sides, we can compute the remaining side. This translates into a very practical rule of project management.

The Project Management Triangle

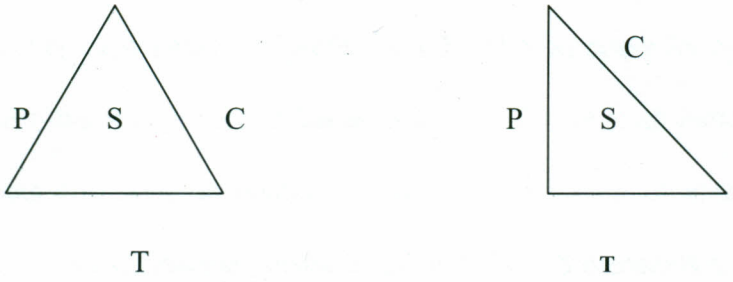

Figure 2.2: Triangles showing the relationship between P, C, T and S

(**Source:** Fundamentals of Project Management, **Lewis, 2007)**

The sponsor can assign values to any three variables, but the project manager must determine the remaining one. In this study, the project manager determines the performance of the project through PM&E.

2.3 Empirical Review

2.3.1 Project Sustainability

According to Nabris, (2002), sustainability in simple terms is a measure of the continuation of the project program or positive results after external support has been concluded. It has become a major issue in development work and evaluation of projects. Many development initiatives fail once the implementation phase is over because neither the target group nor responsible organizations have the means, capacity or motivation to provide the resources needed for the activities to continue. As a result, many development organizations became more interested in the long-term and lasting improvements of projects. In addition, many donors are becoming interested to know for how long they should need to support a project before it can run with local resources.

During the last decade, the concept of sustainability has been developed from merely asking whether the project has succeeded in contributing to the achievement of its objectives or whether the project will be able to cover its operational costs from local sources to a broader set of issues including if there is an indication whether the positive impacts are likely to continue after the termination of external support. In addition, environmental, financial, institutional and social dimensions have become major issues in the assessment of sustainability.

Since sustainability is concerned with what happens after external support is completed, it should ideally be measured after the completion of the project. It will be difficult to provide definitive assessment of sustainability while the project is still running. In such cases, the assessment will have to be based on projections about future developments.

There are a number of factors that can be used to ensure that project interventions are likely to become self-sustaining and continue after the termination of external funding, including; economic (future expenses, especially recurrent costs); institutional (administrative capacity, technical capacity, institutional; motivation, ownership of the project, etc.); social (community interest, political will, etc.); factors related to overall environmental benefits.

Silva and Kepe (2010) examined the concepts of 'participation' and 'sustainability' in a food security project among the rural poor in northwestern Tanzania through a case study of a community development project. The study explored whether it is possible to balance the goal of project sustainability with reaching out to the most vulnerable groups in rural communities, particularly the poorest people with limited resources. Based on data collected through a short questionnaire, semi-structured interviews participant

observation and a number of Participatory Rural Appraisal (PRA) techniques that included wealth ranking among others, the study concludes that there is a growing segment of the poor who face too many constraints to participate, become "empowered" as well as advance the well-intentioned goals of sustainability of community development projects. The result, the paper argues, is that the poor can remain on the margins of projects that were meant to get people out of poverty. "There is a need in development projects to match the language of "participation", "empowerment", and "sustainability" with a bias towards poor people.

2.3.2 Stakeholder Concerns and PM&E

According to the study on 'Power perceptions in participatory monitoring and evaluation' that was undertaken by Parkinson in Uganda (2009) through the examination of a case study of a large rural development programme in Uganda, PM&E is often premised on the assumption that programme goals and participants 'goals are mutually compatible. Since the ultimate goal of development programmes is typically stated as the improved wellbeing of the participants, who are its target beneficiaries, this assumption may seem self-evident. And yet it sidesteps the reality of the inherent power differentials between programme implementers and the programme's target beneficiaries. Such power differentials, and their implications for the nature of participation within programmes, have been well documented by other authors (Cleaver, 2001; Cooke & Kothari, 2001; Mosse, 2005; as cited by Parkinson, 2009)

Von Bertrab and Zambrano (2010) undertook a study, titled 'Participatory Monitoring and Evaluation of a Mexico City Wetland Restoration Effort', in Mexico. Examining a real project management situation, they found that the Restoration Ecology Laboratory of

the Institute of Biology, Universidad Nacional Autónoma de Mexico together with local fisher groups, with funding from local government, implemented a project to reduce non-native fish by drawing on local fishing expertise.

To improve project management, project coordinators established a participatory monitoring and evaluation scheme, which provides a basis for understanding local livelihood strategies and stakeholder priorities. Recognizing that there are differences among stakeholders and establishing institutional arrangements that account for these differences can result in more inclusive projects based on mutual understanding and cooperation. This, in turn, yields better results.

However, group dynamics, local political alliances, and powerful actors turn participation into an intricate social process. Restoration practitioners who are serious about participation should bear in mind that a participatory approach may add complexity to project implementation, but the outcome may be more sustainable restoration projects. Von Bertrab and Zambrano (2010) concluded that PM&E provides a set of practices and tools that allow the integration of various stakeholders' interests, needs, and priorities in the design of sustainable development interventions—including those related to environmental management—and in measuring and judging performance of projects.

In Nigeria Ogunlade (2007) undertook a study involving backyard fish farmers in Osun state. The need for increase in fish production in order to improve protein intake by Nigerians led to this study. The study analyzed information needs of backyard fish farmers in Osun State, Nigeria. Specifically, the study investigated the socio-economic characteristics of backyard fish farmers, frequency of performance, importance and

difficulties of management practices as well as the constraints facing backyard fish farming. Using the snow balling sampling technique, 70 farmers formed the sample. The research design for the study was survey and correlational. The instrument used was a well structured questionnaire and personal interview for those who could not read or write, based on the items on the questionnaire. The findings indicated that backyard fish farmers in Osun State were mostly males, middle aged, married and most of them rear catfish, Feeding and cleaning are frequently performed by the fish farmers, feeding and maintenance of water quality were of extreme importance and also cleaning and harvesting were found to be extremely difficult.

There have been known to exist characteristic differences in the implementation of PM&E by different nationalities as indicated by research undertaken by de Bony (2010), on 'Project management and national culture'. The researcher used a case study to explore the impact of national context in the integration of project management during a Dutch/French cooperation. Evaluation and monitoring are easily adopted by the Dutch whereas they are avoided by the French partners. Using qualitative and inductive research, the study unravels the entanglement of the practice in two different contexts. It sheds light on the role of Dutch consensus as making the transfer of the practice easier. It reveals the difficulty encountered in making project management a part of French logic of 'métier'. The research underlines the fact that weak and limited articulations between the individual and the group and between the persons and their activities are key factors in the appropriation of project management. It proposes an analytical framework adapted to investigate managerial practices within their contexts of implementation.

It may well be that one cannot base the perception of Kenyan fish farmers towards PM&E on that of the Ugandan farmers as found in the study undertaken by Parkinson (2009). While I agree with Parkinson, that 'farmers within the programme may feel that the bureaucratic and accountability requirements of PM&E are not their concern and hence may not feel obliged to continue with it once the government pulls out of the project,' it could conversely be a matter of contrasting cultural inclinations as found in the study undertaken by de Bony (2010) between the Dutch and the French.

What is more; Ogunlade (2007) asserts in his study on Backyard fish farmers' Information needs in Osun Nigeria, that 'feeding and cleaning are frequently performed activities by the fish farmers, feeding and maintenance of water quality were of extreme importance and also, cleaning and harvesting were found to be extremely difficult'. Based on this information this study proposed to explore whether sound record keeping for PM&E would be a priority to such farmers in Kiambu, whose full occupation and energy is focused on the "frequent and extremely difficult activities," unless they are very well trained to understand that the sustainability of their projects lies in their commitment to track project Success through PM&E. This attitude determines the momentum with which the anticipated socioeconomic development will roll out from the aquaculture sub-sector because it is critical for monitoring project performance.

2.3.3 Project Performance

Kim (2009), from his study, 'Project success indicators focusing on residential projects: Are schedule performance index and cost performance index accurate measures in earned value?' he indicates that; as a concept of project control that provides a quantitative measure of schedule and cost information, Earned Value (EV) can evaluate work

progress by identifying potential delays and cost overruns. When EV is used as a construction control technique, the Schedule Performance Index (SPI) and the Cost Performance Index (CPI) are the core factors in the EV system. The standard is only 1, i.e., 1.0 above or below. Though the two indices have important roles in the EV system, those indices do not always show the project status exactly; for example, when Planned Value (PV), EV, and Actual Cost (AC) are not collected in a timely manner. Additionally, there is no guideline on how each value in SPI and CPI is understood or how to read the hidden meaning behind the construction status. Therefore, the study first speculates about the meaning of the two indices, then suggests a practical application, and finally shows the framework where the two indices apply to various types of construction.

While most of the available literature focuses on the construction industry, it is important to note that the principles governing the PM&E of these projects remain the same for biological projects like fish projects which are the object of this study. It is worth noting that for the project status to show at any one time, planned value (PV), earned value (EV) and actual cost (AC) must be collected in a timely manner according to Kim (2009) which translates to consistent record keeping by fish farmers targeted in this study.

The study done by Kiess and Morgan (2010) titled 'Six States Defined by Earned Value Variance and Its Use to Form New Project Performance Indicators' proposes the use of earned value casts a project's status into one of six states of earned value parameters at any time, determined by tile relative magnitudes of tile cumulative EV, PV, and AC. This is a truism not heretofore widely recognized. It has a useful application, in that a project's overall Success in an earned value sense is state-dependent, so identifying which of the

six states a project is in, and how often a project has been in each state, are useful indicators of project performance. This article illustrates these concepts with a case study that shows the utility of introducing a new variance (BV) and index (BPI) in order to distinguish all six states, and then to form two new discriminating project performance indicators: the average time in each state (m/t), and a cumulative average performance index (API). The authors found these two quantities to correlate with project Success.

This study did not adopt the use of indices although it took cognizance of the parameters of Cost performance and Schedule performance as project performance indicators in the fish projects of the study. Instead, the study being cross-sectional, proposed to use relative average output, cost and timeliness of the projects at the time of the study. The base data that could have been used to form the basis for indexing was not yet established because the fish projects were relatively young, the oldest about 3 years old.

2.3.4 Measuring Project Performance

In a study titled 'Monitoring Elite Capture in Community Driven Development' Platteau (2004) states; "a lot of attention has recently been given to improving ways of assessing the effectiveness of development interventions. This is to be welcomed especially with regard to community-based or participatory aid projects, since considerable resources are currently being earmarked for these by almost all types of donor agencies including large international organizations..."

It is obvious that sound record keeping is critical for PM&E and "a source of information that can be shared for the greater good of their communities" (Parkinson, 2009). According to the Agribusiness Manual for the Department of Livestock Production (DLP, Agribusiness Manual, 2010), Farm records are critical for generating information on

business activities and for assisting the farmer in self monitoring and evaluation among other uses. (DLP, Agribusiness Manual, 2010) This study proposed that consistent and quality record-keeping by the fish farmers in this study could be used for purposes of PM&E by all the relevant stakeholders, if done correctly. The challenge is to get the fish farmers to understand that the information generated by their records is crucial to the very survival and growth, of the aquaculture sub-sector for wider socioeconomic development.

In a study titled 'Project management at the crossroads for iNGOs (choice of directions for international non-governmental organizations)', Cropper (2010) indicates that iNGOs are faced with two difficult decisions, whether to stay as they are and deal with the consequences of fewer resources, loss of reputation, and increased risk; or to change and learn what other sectors have already learned, that project management is a vital skill for effective delivery, and without such delivery of projects, the organization will have nothing to show for their efforts. Analyses the projects at a typical iNGO and concludes that they make a large investment in project design, at the beginning of the project cycle, and then make a large investment at the end of the project in terms of monitoring and evaluation, with a void in the middle that can lead to poor project delivery and implementation. Cropper (2010) suggests ways in which this problem may be approached in future, and concludes that, in organizations where project management is a priority there is a shared understanding of the role and importance of project management and project managers in the organizations.

Matthieu, and Didier, (2010) in their study 'Towards a multi-dimensional project Performance Measurement System' undertaken in Toulouse, France, discussed the difficulty of controlling a complex project caused by the great number of performance

indicators. The problem studied is how to allow project managers better control the performance of their projects. From a literature review they noted several critical aspects to this problem: there are many dimensions for evaluating project success (cost, time, quality, risk, etc.); performance factors should be able to be relevantly aggregated for controlling the project, but no formalized tool exists to do this. They suggested a method to facilitate project success analysis via a multi-criteria approach. The method focuses on three particular axes for the analysis of project Success: project task, performance indicator categories, and a breakdown of the performance triptych (Effectiveness, Efficiency, Relevance). Finally, the MACBETH method was used to aggregate performance expressions. An application case study examining a real project management situation was included to illustrate the implementation.

This study adopted the framework suggested by Matthieu and Didier (2010), for project Success albeit with a slight variation. The two research variables are Project Control and Project Success. The study apportioned the Project Control variable into Project Quality and Cost Performance, while the Project Success variable was sub-divided into Schedule Performance and Project Output. This study proposed to facilitate Project Control and Project Success analysis through a Multi-Criteria Decision Analysis (MCDA) approach using the Weighted Sum Model (WSM) method to analyze the research instead of the MACBETH method. This is because the WSM method is more acceptable for multi-dimensional problems such as the one under study. Multi-dimensional problems have mixed measurements while the MACBETH method is suited for qualitative analysis only.

According to Bouyssou et al., (2001), the Weighted Sum Model applies when dealing with multi-dimensional evaluations of alternatives, the basic and almost natural (or

perhaps, cultural?) attitude consists in trying to build a one dimensional synthesis, which would reflect the value of the alternatives on a synthetic "super scale of evaluation". This attitude is perhaps inherited from school practice where all other performance evaluations of the pupils have long been (and often still are) summarized in a single figure, a weighted average of their grades in the various subjects. Starting from the standard situation of a set of alternatives a ϵ A evaluated on n points of view by a vector

$g(a) = (g_1(a), g_2(a), \ldots, g_n(a))$, we consider the value f(a) obtained by linearly combining the components of g , i.e.

$$f(a) = k_1g_1(a) + k_2g_2(a) + \ldots + k_ng_n(a)$$

Suppose, without loss of generality, that all criteria are to be maximized, i.e. the larger the value $g_i(a)$, the better the alternative a on criterion i (if, on the contrary, g_i were to be minimized, substitute g_i by $-g_i$ or use a negative weight k_i). Once the weights k_i have been determined, choosing an alternative becomes straightforward: the best alternative is the one associated with the largest values of f. Similarly, a ranking of the alternatives is obtained by ordering them in decreasing order of the value of f.

This simple and most commonly used procedure relies however on very strong hypotheses that can seldom be considered plausibly satisfied.

Bouyssou et al. (2001) suggests that the weighted sum is useful for obtaining a quick and rough draft of an overall evaluation of the alternatives; one should however keep in mind that there are rather restrictive assumptions underlying a proper use of the weighted sum. They summarize these conditions as follows:

Cardinal character of the evaluations on all scales: The evaluations of the alternatives for all criteria are numbers and these values are used as such even if they result from the re-coding of ordinal data, as has been done in this study.

Linearity of each scale: Equal differences between values on scale i, whatever the location of the corresponding intervals on the scale (at the bottom, in the middle or at the top of the scale), produce the same effect on the overall evaluation f: if alternatives a, b, c, d are such that

$g_i(a) - g_i(b) = g_i(c) - g_i(d)$ for all i, then $f(a) - f(b) = f(c) - f(d)$.

The weights are trade-offs

Weights depend on the scaling of the criteria; transforming the (linearised) scales results in a related transformation of the weights. Weights tell how many units on the scale of criterion i are needed to compensate one unit of criterion j.

Preference independence

Criteria do not interact. This property, called preference independence, can be formulated as follows. Consider two alternatives that share the same evaluation on at least one criterion, say criterion i. Varying the level of that common value on criterion i does not alter the way the two alternatives compare in the overall ranking.

The researcher agrees with Platteau (2004) that attention must now be drawn to assessing the effectiveness of these pond fish production projects in their contribution towards achievement of the development objectives of the aquaculture sub-sector. It is the same contribution that will augment what the larger fisheries sector contributes to the achievement of the national goals of Vision 2030 and the Millennium Development Goals (MDGs). This study aimed to assess the economic sustainability of the fish projects

in relation to the level of PM&E appropriation at farm level, in order to establish if the two factors have a relationship that could be used to illustrate the role that the PM&E has in affecting project sustainability. For the purposes of this study, 'Project Success' is indicative of the potential for economic sustainability of the fish projects while 'Project Control' is concerns the level of operational compliance of the projects, based on the technical standards, also referred to by Laszlo (1999) as process management.

Matthieu and Didier, (2010), in their study titled 'Towards a multi-dimensional project Performance Measurement System', propose that there are many dimensions for evaluating project Success, such as cost, time, risk, quality among others. These are performance factors that should be able to be relevantly aggregated for controlling the project although no formalized tool exists to do this. The conceptual framework of the study borrows heavily from the same school of thought, proposed by Matthieu and Didier. The Independent Variable is Participatory Monitoring and Evaluation (PM&E), for purposes of the study; this has been decomposed into four performance factors namely; Project Quality, Cost performance, Schedule Performance and Project Output. The Dependent Variable is sustainable fish production in pond aquaculture.

2.4 The Project Control Variable

2.4.1 Project Quality

In a study titled 'Project and programme diagnostics: a systemic approach', Jaafari (2007) aimed to address project and programme Success assessment and its relationship to traditional project monitoring and control by reviewing the literature on Project Health, critical success factors, project excellence models, the application of TQM principles to project assessment. The researcher argues that a Project Health (PH-Check) should seek

to identify the presence of goals and targets; evidence of systematic identification and appraisal of managerial performance; evidence of development and application of appropriate measures to address identified shortcomings; the effectiveness of the measures in meeting key performance indicators; and evidence of operational and statutory compliance. Examines the relationship between PH-Check, a toolset designed for project/programme Success assessment, and project life cycle; sets out the scale for management capability assessment in the PH-Check methodology; and explains the components of the PH-Check framework - criterion, indicators and metrics. Outlines the PH-Check assessment process, and illustrates its application to two case study projects.

Quality authority Sowards (2004) in his article 'High Performers know the score', discusses the High-Performing Contractor Assessment Model developed by Sheet Metal and Air Conditioning Contractors' National Association. He stresses that keeping score is important for high performing contractors. They don't lose sight of the importance of focusing on the right measures (also called metrics in this column) as well as the equally important analysis of measures to get to the root cause and to take preventable action. This agrees with keeping records to track project performance and taking corrective measures in project control. Sowards adds that high-performing contractors keep score for what they call their Critical Success Factors (CSF) also called the Key Result Areas (KRA). These are the areas or high-performing contractors see measurement as a tool to evaluate the performance of their processes and systems. They do not use or assume that any measures actually measure the performance of individuals. In today's world, no one works completely alone and independently. Measures show how our systems are working, not how any one person is performing.

There are two kinds of measures: after the fact and in-process measures. In this study, after the fact measures would be project Success variables (schedule performance and project output) and in-process measures, project control variables (project quality and cost performance).

Laszlo (1999) in his study 'Project management: a quality management approach' examines the feasibility and practicality of applying a quality management approach to project management. The model used for the analysis is the criteria of the Canada Awards for Excellence, the internationally recognized quality award program. He states that process management is sometimes mistakenly confused with project management. It is possible to manage a project as one complex process, although managing a project as a collection of processes provides more opportunities and benefits for the project manager.

It is advantageous for the project manager to identify the key processes within the project to have the opportunity to manage each process and coordinate them to avoid the burden of managing the complexity of the entire project as a single entity. This approach also provides the ability to focus on each process, and thus benefit from such established techniques as process control, process capability studies, and process optimization. (Laszlo, 1999)

It is this process management (Laszlo, 1999) or in-process measures (Sowards, 2004), that this study refers to as Project Quality. In-processes measures or "indicators," are not so good for knowing the score but are most useful for making changes during the game to influence the outcome (Sowards, 2004). Project Quality comprises of indicators that are concerned with the extent to which farmers are engaged in PM&E; such as degree of awareness towards importance of record-keeping, accuracy and timeliness of records

kept, reaction to outcome of records with regard to project control, reasons for not undertaking PM&E and self-evaluation by the fish farmers. The data elicited from this indicator was qualitative and ordinal.

Findings for the study undertaken by Jaafari (2007) indicated that the systemic approach to project and Programme diagnostics demonstrates a methodology that assesses the quality of the practices applied to manage the project through the assessment of a series of indicators that represent the enabling factors, and which can be applied throughout project life to track the managerial performance.

2.4.2 Cost Performance versus Schedule Performance

Earned value (EV), a simple, but very practical concept, is founded from the Cost/Schedule Control System Criteria (C/SCSC). Since 1967, the U.S. Department of Defense has applied the C/SCSC to major businesses with a high risk of cost increase to measure the outcomes of the projects (Singh 1991; Niemann 1991, as quoted in the work of Kim, 2009). The simplified concept for fitting the diverse baselines of C/SCSC to enterprises is the Earned Value Management System (EVMS) (Fleming and Koppleman 1996, as cited by Kim, 2009). The concept of EVMS is important because the primary objective during the construction process lies in completing the project on time and within the budget while meeting established quality requirements and other specifications (Rasdorf and Abudayyeh 1991, as quoted in the work of Kim, 2009). Therefore, many developed countries have been using the EVMS for an array of public and private practices since the early 1990s, resulting in a dramatic improvement in companies' construction practices.

There are two indices in EVMS: the schedule performance index (SPI) and the cost performance index (CPI). The SPI and CPI show the schedule position and current cost of the project. With the two indices, the construction manager or site manager can judge whether a project is ahead or behind schedule, and if it is within or over the budget. However, are the SPI and CPI the absolute standard of performance? If the SPI is below 1.0, (e.g., 0.998) in the initial construction phase, will the project have a serious problem? Also, if the CPI is over 1.0 (e.g., 2.4), then will cost status be under control?

2.5 The Project Success Variable

2.5.1 Schedule Performance

This is the measure of timeliness in attainment of project milestones. It reflects the effectiveness of project time management. Scheduling of activities is followed by controlling the work to ensure that tasks are done at the scheduled time. (Lewis, 2007) There is a major difference however, between construction projects and biological projects, of which aquaculture is part, in the sense that when there occurs project schedule overruns in biological projects, the project can never recover the cost at a later date.

For aquacultural and agricultural projects, timeliness has a cost implication. This is due to the changing growth rate of the fish with age as with all living entities. Disruptions in the feeding programme for example, in the earlier stages of the project results in stunting which eventually frustrates attainment of requisite market weight at the expected market age. Efforts to extend the project duration allow for further weight gain not only results in cost overruns but also inability to gain any weight, leading to unnecessary losses.

In an article that shows the importance of timeliness to weed control and shares the aspects of grassweed control that are the focus of Andrew Gloag, a grower from Yorkshire, England and the recipient of the 2009 Farmers Weekly Arable Farmer of the Year. Gloag employs a cultural control technique that relies on crop competition alongside a good seed-bed, optimum drilling date and the right seed rate. He also shifted to pre-emergence-based herbicide program. From the moment the harvester leaves the field to when the last autumn herbicide is sprayed, there is an admirable clockwise precision to autumn fieldwork followed by 2009 Farmers Weekly Arable Farmer of the Year Andrew Gloag.

"The whole job comes down to one aspect, and that's timeliness," he states. "It starts with cultivations and goes right the way through. Timeliness is the key and there's no compromise." (Gloag, 2010)

A study undertaken to show a method of estimating timeliness costs in forage harvesting, illustrated using harvesting systems in Sweden, (Gunnarsson, Spörndly, Rosenqvist, Toro and de Hansson, 2009) showed that yields of forage for silage were significantly higher for the first cut compared with the second or third cuts in the season. It is, therefore, important to avoid delaying the first cut. The timeliness costs also varied greatly between years ... costs were outweighed by increasing timeliness costs due to a longer duration of harvest. At increasing transport ... timeliness costs it is important to avoid delays in harvesting (Gunnarsson et al., 2009)

2.5.2 Project Output

These are the Project Outputs, or the immediate tangible results that can be verified as the project progresses. Sowards, (2004) refers to them as CSF metrics; which in this study

are the Project Output attributes, such as average pond population, average weight at first harvest, percent average units at harvest, frequency of disease incidence or predator attacks. These are all considered results of PM&E on Project Success. According to Sowards (2004), The CSF metrics are usually after the fact measures, as we don't typically see them until a few weeks after the month's end. While these are good for knowing the score, they tell us history and by them we have either won or lost the game. They are useful for evaluating past performance and predicting the future, but by their very nature they are late.

2.6 Research Gaps

Both production and price trends of fish farming under aquaculture since 2006 have consistently been upward. This is not expected and it calls for investigative research into how well these fish projects are contributing to the fish supply in the market. The extent to which fish farmers are involved in PM&E will provide a basis, through their records, of evaluating the effectiveness of these projects in fish production. How is the aquaculture sub-sector performing at the primary (Producer) level? There is need for research studies to generate the required information from which a basis can be formed to critically examine whether or why the sub-sector that seems to have resounding success at the project adoption level (Muiruri, 2010) would be under-performing at the market supply level (Silva & Kepe, 2010). This study will contribute towards such knowledge.

Project sustainability is more complex than economic sustainability alone. Other aspects critical to project sustainability include the political, socio-cultural, technological, environmental, demographic and legal conditions that all contribute to project

sustainability in one way or another. Further research would take one or more of these aspects to explore the influence on project sustainability.

The related empirical studies that have been done in Kenya have centred on participatory research, (Misiko, Tittonell, Ramisch, Richards, and Giller, 2008; Kahindi, et al, 2010; Roba & Oba, 2007) or participatory evaluation (Walingo, 2006; Mureithi, Gachene and Wamuongo, 2005). This participatory research presents examples of participatory monitoring surveys (Kahindi et. al.) and evaluating surveys (Roba & Oba, 2009) respectively, in which researchers have engaged the communities on the ground to get involved at the secondary level.

This study however, aimed to investigate the actual PM&E practice by farmers, at the primary level, of their own projects. At this primary level, the study assumed that PM&E forms the basis of project assessment to examine project sustainability.

2.7 Conceptual Framework

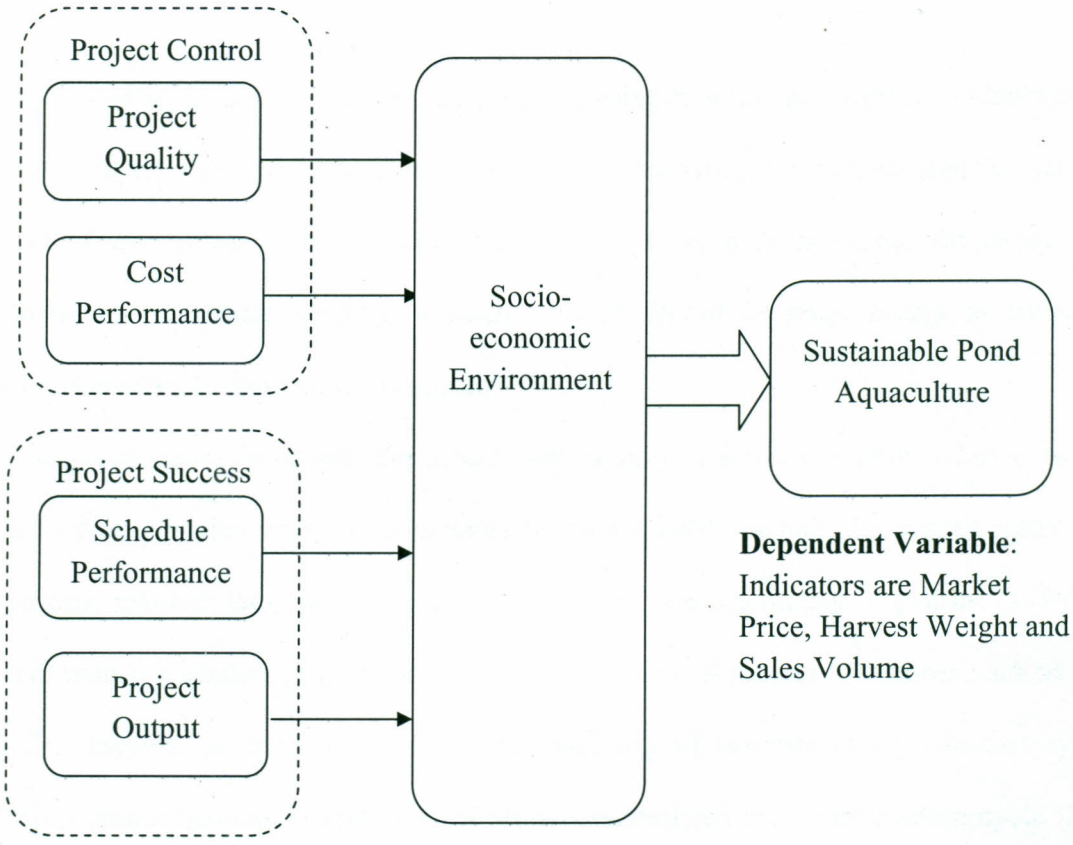

Figure 2.7: Conceptual Frame Work: (**Source:** Researcher, 2011)

2.8 Operationalization of Variables.

2.8.1The Independent Variable

The independent variable was split into two research variables, namely, project control and project success. Project control is further decomposed into project quality and cost performance; and project success into schedule performance and project output. Project

quality, cost performance, schedule performance and project output are the statistical variables by which PM&E was measured.

Project quality is compliance by the project manager, with the technical guidelines of project implementation, in the execution of project activities. It was measured through the level of awareness in record keeping, reaction to records outcome, frequency and consistency in record keeping, attitude towards record keeping, access to technical extension services and market awareness.

Cost performance measures the actual cost of project implementation relative to the planned or expected cost. The indicators for this variable include the cost of water and nutrition management; pond cleaning, harvesting and marketing expenses. Schedule performance measures project timeliness in attainment of project milestones such as age at first harvest, production turn-over and frequency of harvests in a production cycle. Project output magnitude and value of production realized in one production cycle. This was measured through average pond population, average weight at first harvest, pond productivity, mortality rate, losses due to predators, type and location of target market and domestic consumption.

2.8.2 The Dependent Variable

The dependent variable was measured through the sales volume, harvest weight and the market price. The price is also dependent on the overall market supply and demand of the fish; over-supply will bring fish prices and down vice versa.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter explains the research design, population, sample design, research sample, data collection and data analysis.

3.2 Research Design

The research design that was used in this study was descriptive and exploratory interview survey. The study was aimed at collecting information from respondents on their involvement in project activities in relation to the Fish Farming Enterprise Productivity Project (FFEPP) in Kikuyu, Lari and Githunguri districts, Kiambu County. It adopted a deductive approach. The tool that was employed was farm to farm survey. The researcher used both primary and secondary data. Primary data was obtained using interview schedules and observation guides while secondary data was obtained from the internet, journals and books.

3.3 Target Population

The target population for the study consists of all the pond fish farmers who are beneficiaries of the ESP in Kiambu County. The Implementation Guidelines for FFEPP, 2010/2011 show that there is a total population of 300 such farmers in Kiambu. The accessible population in the area of study was pond fish farmers in Kikuyu, Lari and Githunguri districts, in Kiambu County, purposively selected owing to the comparative presence of more farmers in these three areas engaged in pond aquaculture. The study targeted the project manager, who was defined as the implementing agent on the farm. Respondents included the project owner, volunteer worker, employee or relative of the project owner, so long as they were the implementers of the project.

Any farmer in the project area was engaged in either fingerling or table-size fish production. The study targets table-size fish production. These projects are all at different stages in the production of the fish, owing to the staggered provision of government funding for the initial pond construction since 2008; and of the periodic availability fingerlings that the farmers must buy to stock the pond for table-size fish production. The study targeted the farmers who had harvested at least once, either partially or fully. At the time of the study, there was no reliable data on these farmers because the stocking to harvesting period also depends on level of management of the individual farm.

3.4 Sampling Design

Saunders et al (2007) states that purposive sampling with a focus on an appropriate theme can be used for large populations, where it was not usually possible to obtain a sampling frame or when the focus of the research is statistical generalization to theory and not to the population, as it was in this study. The three project locations of Kikuyu, Lari and Githunguri districts had been purposively selected due to their relatively higher population fish farmers in comparison to other districts in Kiambu County. The target population was not readily identifiable in spite of having the fish ponds. Project failure, problematic projects which had never attained market weight, new entrants who had not harvested yet, projects that were awaiting fingerlings to stock their ponds or fingerling producers had made it impossible to obtain a sampling frame for table-size fish producers, since they are all mixed up on the ground. Kiambu was among the first to receive ESP funding for FFEPP and was hence appropriate for examining sustainability of the fish pond projects.

In agreement with Saunders et. al., (2007), snowball sampling was done to raise the samples within the three project districts because the farmers on the ground were all at varying stages of the production cycle, with some undertaking fingerling production which was not the object of this study. Information was sought from a respondent on where the nearest farmer who had harvested at least once could be found. The latter would form the next respondent. This would continue until the sample of 34 was attained in each of the three selected project districts.

The sampling unit was the single individual farmer and beneficiary of the ESP who owns one fish pond (300 square metres) in the area of study; was engaged in table size fish production for consumption, and had harvested fish at least once, prior to the time of the study. In order to generalize statistically about the theory rather than the population as with non-probability sampling, the logical relationship between the sample selection technique and the purpose and focus of the research was more important than the sample size. (Saunders et al, 2007).

3.5 Research Sample

Saunders et al., (2007) indicate that statisticians have shown that a sample of 30 or more will usually result in a sampling distribution for the mean that is very close to a normal distribution; and a minimum number of thirty (30) for statistical analyses provides a useful rule of thumb for the smallest number in each category within the overall sample Stutely (2003, as cited in Saunders et al., 2007), given a response of rate of 100%. Response rates affect the sample size and must be taken into consideration if the final sample size was to remain truly representative of the population from which the sample is

taken. This study had assumed a response rate of 90% based on similar survey studies conducted on a face to face basis. (Saunders et al, 2007)

With a response rate of 90%, the adjusted sample size had a minimum of thirty-four (34) respondents. Saunders states that response rates can vary considerably when collecting primary data. Neumann (2000), as cited by Saunders et al. (2007), suggests response rates of between 10 and 50 percent for postal surveys and up to 90% for face to face interviews from studies done in the UK. The researcher had been granted access by the MOFD and was accompanied by Fisheries' field staff during data collection, to facilitate access to the fish farms. Each of the three purposive samples had an equal number of thirty-four (34) respondents, totaling to one hundred and two (102) for the research sample.

3.6 Data Collection

3.6.1 Research Instruments

The type of data that was collected in the course of the study was primary and secondary data at fish farmer level. A well structured interview schedule bearing closed ended questions was administered in a face to face approach to the respondents to collect primary data. An observation guide was also used to collect primary data based on the records kept at farm level, and the state of pond security.

3.6.2 Reliability of Research Instruments

The interview schedule was tested for internal consistency (reliability) by employing Cronbach's alpha which is a general form of the Kunder-Richardson's (KR_{20}) formula:

$$KR_{20} = \frac{(K)\,(S^2 - \sum s^2)}{(S^2)(K-1)} = \frac{21494.5}{40120} = \mathbf{0.536}$$

Where:

KR_{20} = Reliability Coefficient of Internal consistency. (0.536)

K = Number of items used to measure the concept. (5)

S^2 = Variance of all scores. (10030.0)

s^2 = Variance of individual items.

(495.5, 72.1, 459.5, 342.8, 4361.2)

(See table 4.3.4 for above values).

Based on the split-half reliabilities of data from all possible halves of the instrument, it reduces the time required to compute a reliability coefficient. (Mugenda & Mugenda, 2003). Cronbach's alpha is a statistic. Some professionals insist on a reliability score of 0.70 or higher in order to use a psychometric instrument. This rule should be applied with caution when α has been computed from items that are not correlated. (Choudhury, 2010). The reliability score for this instrument based on Cronbach's alpha is 0.536. This indicates that the psychometric instrument that was used was fairly reliable.

3.6.3 Validity of Research Instruments

The researcher sought the expert opinion of the supervisors to assess the validity of the interview schedule and observation guide. The researcher minimized sensitivity of questions requiring a definite value such as age, production and financial values by giving ranges instead of definite figures that normally result in deliberate inaccurate data due to the respondent effect... (Kothari, 2006) The researcher also used indirect criteria such as man days to indicate the cost incurred to undertake certain activities at farm level. The researcher controlled for the intervening variable by including its variables in the interview schedule in order to take account of the effect they may have on validity.

3.7 Pilot Testing the Research Instruments

The researcher pilot tested the interview schedule with a sample similar to the target population. Up to 15% of the sample size was targeted by the pilot test. According to Mugenda and Mugenda (2003), the purpose of pre-testing the instrument was to ensure that the items are clearly stated and have the same meaning to all respondents. The researcher was able to assess the clarity of the instrument and the time taken to administer the interview schedule.

3.8 Data Collection procedures

The data collection techniques entailed researcher administered semi-structured interviews based on the contents of the interview schedule. Complete observer structured secondary observation was also undertaken by the researcher to verify the level of record-keeping by the respondents as well as pond security. Using closed ended questions, checklist questions were employed. More secondary data was obtained from Internet, journals, periodicals and books. The research used a highly structured methodology to facilitate replication, an important issue to ensure reliability. (Saunders et al, 2007). The study was conducted in the month of April-May 2012.

3.9 Data Analysis procedures

All primary data collected was ranked. Categorical data was assigned numerical codes (quantitized) and ranked to give ordinal data. Similarly, numerical data was ranked. This study had proposed to use the correlation coefficient to analyze the degree relationship between two variables. The Pearson's Product Moment Correlation Coefficient (PMCC) was used to analyze two isolated independent and dependent variables whose data is quantifiable and of a continuous nature. (Kothari, 2006)

In order to assess the likelihood of groups within the research population being different occurring by chance alone; the study used the Chi-Square Statistic. If the likelihood of any difference between groups occurring by chance alone is low, this was represented by a high level of significance with a p-value probability of less than 0.05.

The study had also proposed use the Multi-Criteria Decision Analysis (MCDA) approach to analyze the four PM&E factors (statistical variables), namely Project Quality, Cost Performance, Schedule Performance and Project Output for performance value, and the intervening variables (Record Keeping and Pond Security) using the Weighted Sum Model (WSM) of the maximization case method (Bouyssou et.al, 2001).

The study assumed that the statistical variables (Project Quality, Cost Performance, Schedule Performance and Project Output all bear equal weight of 6.00. The performance value was shown by the computed value, given that C_1, C_2, C_3 and C_4 have relative weights of 0.1, 0.2, 0.3 and 0.4 respectively. (Refer to Appendix III). Adopting the WSM, for the purposes of the study, the research problem had been defined by four (4) Alternatives, namely Project Quality (A_1), Cost Performance (A_2), Schedule Performance (A_3), and Project Output (A_4). The Decision Criteria (C_1 to C_4) are ranked from Level 1 to Level 4, with increasing benefit. It was these ranks that represented the corresponding values of the decision criteria for purposes of analysis. The ranks are similar for all the data and hence will allow for the principle behind the WSM to work. Similarly, The Alternatives (A) have been weighted based on the number of attributes under each Alternative.

Based on the work of Bouyssou et.al (2001), starting from the standard situation of a set of alternatives A_i evaluated on 4 points of view $C_{1 \text{ to } 4}$, (decision criteria) by a vector

$$C(A_i) = (C_1(A_i), C_2(A_i), \ldots, C_n(A_i)),$$

We considered the value $F(A_i)$ obtained by linearly combining the components of C_n, i.e.

$$F(A_i) = W_1C_1(A_i) + W_2C_2(A_i) + \ldots + W_nC_n(A_i)$$

where:

A_i = the relative weight of Alternative (for the study, assumed to be all equal at 6.00; i = 1 to 4)

C_n = the decision criteria (n = 1 to 4)

W = the relative weight of the criteria (n = 0.1 to 0.4)

$F(A_i)$ = the performance value of the Alternative under evaluation.

The model was based on the maximization case, for which the best alternative A_i is the one that yields the maximum total performance value (Bouyssou et. al., 2001). The same analysis was done for the entire research sample to determine the best and worst performing variables in general, or for the three purposive samples, to compare and contrast respective performance trends across project size or project manager categories. It could also rank all the individual farmers based on their overall performance value, or for specific statistical variables.

3.10 Data Presentation

The researcher used statistical presentation such as measures of central tendency, measures of variability and frequency distributions; and graphical presentations such as bar graphs, pie charts and histograms.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter consists of the results obtained from analysis of data collected concerning the role of PM&E in sustainable fish production through pond aquaculture in Kiambu County. The tools of data analysis were Pearson's Product Moment Correlation Coefficient (PPMCC), Chi-Square test and Multi Criteria Decision Analysis – Weighted Sum Model (MCDA-WSM). The results are presented and discussed.

4.2 Response Rate

Saunders states that response rates can vary considerably when collecting primary data. Neumann (2000), as cited by Saunders et al. (2007), suggests response rates of between 10 and 50 percent for postal surveys and up to 90% for face to face interviews from studies done in the UK. Each respondent was interviewed on a face to face basis. The interview was based on a structured interview schedule, examining the role of PM&E for sustainable pond aquaculture. Secondary observation was made using a structured observation guide to collect data on the intervening factors of record keeping and pond security.

Project Location	**Responded**		**Not responded**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Kikuyu	34	33.333	0	0
Githunguri	34	33.333	0	0
Lari	34	33.333	0	0
TOTAL	**102**	**99.999…**	**0**	**0**

Table 4.2: Response Rate

The study targeted one hundred and two (102) respondents who were the project implementers/managers in the three project locations in equal measure. (Table 4.2)

Though the physical tally indicated 100% response rate, the study agrees with Saunders (2007) that non-responsiveness reduced this rate. Non-responsiveness was as a result of deliberate or unintentional false responses owing to suspicion about or misunderstanding of the interview questions respectively.

4.2.1 Gender Distribution

The accessible population in the area of study was pond fish farmers in Kikuyu, Lari and Githunguri districts, purposively selected owing to the comparative presence of more farmers in these three areas engaged in pond aquaculture. The study targeted the project manager, who was defined as the implementing agent on the farm, regardless of gender.

Gender Distribution	**Male**		**Female**		**Total**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Kikuyu	26	76.5	8	23.5	34	100
Githunguri	29	85.3	5	14.7	34	100
Lari	24	70.6	10	29.4	34	100
Total	**79**	**77.5**	**23**	**22.5**	**102**	100

Table 4.2.1: Gender Distribution

Seventy-seven point five (77.5%) of the respondents were men and 22.5% women with Githunguri having 85% of its respondents as men. Lari had the largest proportion of women respondents (29.4%).

Since the study undertook snowballing as the sampling technique within the targeted districts, the figures indicated in table 4.2.1 are not reflective of the general proportions of gender on the ground. Snowballing involved moving to the next farmer who had harvested table size fish at least once, regardless of gender. The ratio of men to women respondents was approximately 3:1 but this could also be as a result of the tendency for

the men in households to take charge of all matters external, regardless of whether they are the project implementers or not.

4.2.2 Age Distribution

The study targeted respondents from the age of 16 years and above. Bracketed in three groups of 15 year intervals up to 60 years and a fourth group for all from 61 years and above. Respondents being a mixed rural population, the study examined the effect of age on project adoption as well as its significance to project sustainability.

Age Distribution (years)	Kikuyu		Githunguri		Lari		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
16 – 30 years	1	2.9	4	11.8	2	5.9	7	6.9
31 - 45 years	10	29.4	10	29.4	12	35.3	32	31.4
46 – 60 years	14	41.2	12	35.3	13	38.2	39	38.2
61 and above	9	26.5	8	23.5	7	20.6	24	23.5
Freq. Total	**34**	**100.0**	**34**	**100.0**	**34**	**100.0**	**102**	**100.0**

Table 4.2.2: Age Distribution

The majority (38.2%) of respondents were in the age bracket of 46 to 60 years and the least (6.9%) in the 16 to 30 years bracket. Corresponding age brackets were fairly evenly distributed across all project locations apart from the 16 to 30 years bracket whose respondents were concentrated in Githunguri.

Considering that this project requires a substantial area of land and other resources such as water, respondents in the age bracket of 16 to 30 years may not have had decision making authority over utilization of the land on which they may be occupying, hence the low frequency. This authority increases with age up to 60 years but the aspect of advancing age beyond 60 years could have hindered the adoption of the project because

farmers in Lari admitted to harvesting only when the youth are available, such as during school holidays. Findings showed that age was significant to project sustainability.

4.2.3 Education Level Distribution

Because fish farming was a relatively new concept, the study examined whether the level of formal education was significant to project adoption and sustainability. The lowest level had no formal education, followed by primary, secondary and post – secondary level in that order.

Education Level	Kikuyu		Githunguri		Lari		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
None	0	0.0	0	0.0	1	2.9	1	1.0
Primary	9	26.5	8	23.5	3	8.8	20	19.6
Secondary	12	35.3	17	50.0	13	38.2	42	41.2
Post - Secondary	13	38.2	9	26.5	17	50.0	39	38.2
Freq. Total	**34**	**100.0**	**34**	**100.0**	**34**	**100.0**	**102**	**100.0**

Table 4.2.3: Education Level Distribution

Majority of the respondents had attained secondary level education (41.2%) followed by those who possessed post secondary education (38.2%). Lari had most of the respondents with post secondary education (50%) while Githunguri had most of those with secondary education (50%). Kikuyu had the largest group of respondents with primary level education (26.5%).

Education level was not significant to project sustainability. Kikuyu which had the largest proportion of primary level respondents had the highest score for project sustainability compared with Githunguri and Lari which had highest proportions of secondary and post-secondary levels of education respectively.

4.2.4 Project Age Distribution

Project age distribution shows the year the project was initiated and their relative frequencies. The study investigates whether the year of project initiation had any influence on project sustainability.

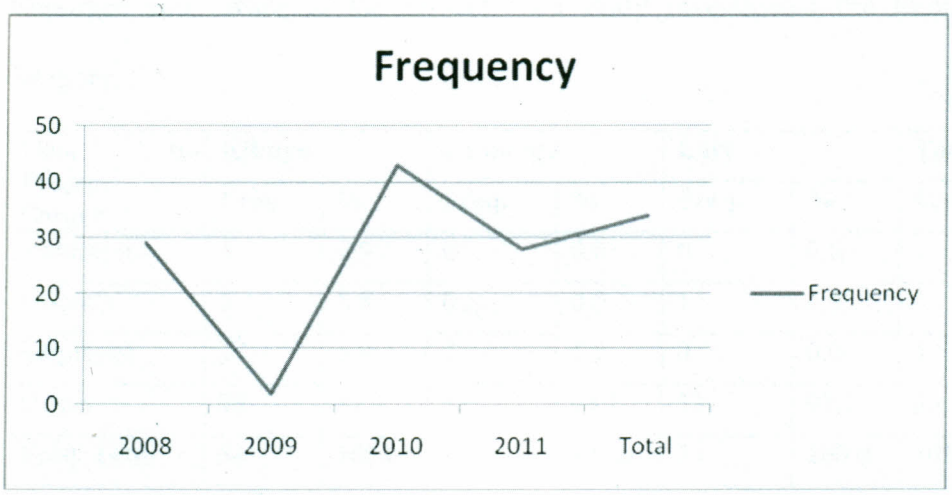

Figure 4.2.4: MCDA Project Age and Frequency

In the first year of the project, 28.4% of the projects were initiated. The number declined drastically to 2.0% in the second year. Majority of the projects (42.2%) were initiated in the third year (2010) and the number (27.5%) declined again in the fourth year (2011).

According to the Implementation Guidelines for FFEPP, 2010/2011, first phase of the Fish Enterprise Productivity Programme (FFEPP) was initiated in 2008/2009 and ended in the 2009/2010 fiscal year. Phase II of the project was implemented within the 2010/2011 fiscal year. Disbursement of funds seems to have been done at the beginning of the first phase, hence the spike in the year 2008. The project's second phase began in 2010/2011 and hence the second spike in 2010 corresponding to increased project entrants, which is higher than in 2008 when the project was initiated in the first phase.

4.2.5 Category of Respondents (Project Managers/Implementers)

Project managers or implementers were defined as the project participants who were executing the day-to-day project activities on the ground. Their status was with respect to the project owner. These respondents fell into four groups; namely volunteer, relative, employee and owner of the project. The study investigated the frequency of each category.

Link to Project Owner	Kikuyu		Githunguri		Lari		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Volunteer	1	2.9	0	0.0	0	0.0	1	1.0
Relative	3	8.8	0	0.0	1	2.9	4	3.9
Employee	2	5.9	2	5.9	0	0.0	4	3.9
Owner	28	82.4	32	94.1	33	97.1	93	91.2.
Freq. Total	**34**	**100.0**	**34**	**100.0**	**34**	**100.0**	**102**	**100.0**

Table 4.2.5: Category of Respondents

Almost all (91.2%) of the respondents were the owners of the project. Equivalent proportions of 3.9% each represent respondents who were either employees or relatives and 1% was volunteers. Kikuyu had highest proportion of relatives and employee respondents combined (8.8% and 5.9% respectively) who are involved in project management/implementation while Lari has the least (2.9%), indicating that almost all respondents in Lari were the project owners.

The frequencies of the above categories may not be a true indication of the situation on the ground because project owners may have felt that they must be the ones to undertake the survey regardless of whether they were the project implementers or not.

4.2.6 Some Challenges affecting the Projects.

The researcher chose to examine a few factors that the fish farmers found challenging to the project and the respondents were asked to rank the same, from 1 to 5, beginning with the most critical at 1. These factors were Liner/Seepage, Technical know-how, Fish size, Predators and Finding market.

	Project Site			
	Kikuyu	Githunguri	Lari	Overall
Challenges	Mean Rank	Mean Rank	Mean Rank	Mean Rank
Liner/Seepage	5	5	5	5
Technical Know How	4	4	4	4
Fish Size	3	2	3	3
Predators	2	1	1	1
Finding Market	1	3	1	2

Table 4.2.6: Challenges by Project Location

The analysis revealed (Table 4.2.6) that Predators is the most critical challenge for Lari and Githunguri and hence overall. This was followed by Finding Market, Fish size, Technical know-how respectively, and least challenging as Liner/Seepage. Githunguri also had a critical challenge with fish size. Finding market for Githunguri was not of critical importance as in Lari and Kikuyu. In Githunguri, farmers had organized fish farmer groups that purchase fish from their members each time one of the members harvests the fish, thus promoting the local/domestic demand for fish.

The study found that predators posed the greatest challenge to the farmers. This being one of the intervening variables whose data was obtained through observation, having found that most farmers had not put measures in place to secure their ponds from predators, it can be posed that a lot of fish is lost to predators and the harvests yield considerably less than expected as a result of this. Finding market and fish size went hand

in hand as most respondents claimed that the bigger the size of fish (from 250 grams upwards) the higher the chance for ready market. PM&E efforts should concentrate on factors that enhance the growth rate of the fish in order to increase the prospects of economic sustainability.

4.3 MULTI-CRITERIA DECISION ANALYSIS - WEIGHTED SUM MODEL OF THE MAXIMIZATION CASE (MCDA – WSM)

The data collected was examined under Multi-Criteria Decision Analysis. Under this tool, the Weighted Sum Model of the maximization case was employed to analyze the degree to which PM&E was undertaken by the respondents from the perspective of the PM&E factors of project quality, cost performance, schedule performance and project output.

4.3.1 Statistical Variables, Alternatives and Attributes

Statistical variables are the four factors that make up PM&E in the conceptual framework. Under this tool they have been referred to as Alternatives. Each Alternative has a number of Attributes which are the indicators that have been used to measure it.

Statistical Variables/(PM&E Factors)	Alternatives (A_i)	No. of Attributes	Unit Weighted Value
Project Quality	A_1	9	0.667
Cost Performance	A_2	5	1.200
Schedule Performance	A_3	3	2.000
Project Output	A_4	7	0.857

Table 4.3 1: Statistical Variables, Alternatives and Attributes

For purposes of this study, an assumption was made that all the statistical variables bear an equal weight of six (6.00) regardless of the number of Attributes that was used the measure the Alternatives. The average weight of 6.00 was obtained by dividing the total number of Attributes (24) by the number of Alternatives (4).

This implies that the more the Attributes the less the unit weighted value although the study did not get into the details of analyzing individual attributes. Attributes were grouped based on the interview schedule that was used to collect data. Their respective total weighted score indicated the degree to which the respondents performed in that factor of PM&E.

4.3.2 Benefit Criteria

These are the four levels of decision making by the project manager with increasing benefit to the degree of PM&E undertaken during execution of project activities. They have been measured by benefit criteria. They are represented by the answers to the interview by the respondents. Each Attribute is valued by any one of the four benefit criteria, according to the responses linked to it.

Benefit Criteria	Weighted Value
C_1	0.1
C_2	0.2
C_3	0.3
C_4	0.4

Table 4.3.2: Benefit Criteria

The benefit criteria, C_1 to C_4 were given the increasing weighted values of 1.0 to 0.4 respectively. The higher the value the greater the benefit to the PM&E factor (Alternative) in question.

4.3.3 Average Performance of PM&E Factors

The performance of each Alternative (PM&E Factor) was based on the aggregated weights of the responses given with respect to that factor. The average performance of

the Alternative took into consideration the number of attributes that were used to measure the Alternative.

Alternative	Total Score	No. of Attributes	Average Score
Project Quality	1525.04	9.00	169.45
Cost Performance	1087.80	5.00	217.56
Schedule Performance	541.20	3.00	180.40
Project Output	1111.80	7.00	158.83
Observation Variables	1173.00	9.00	130.33

Table 4.3.3: MCDA – Average Performance of PM&E Factors

The total score in table 4.3.3 shows results that are not standardized. To make the results more objective, the average score took into consideration the number of attributes that were used to measure each Alternative. The order changes giving cost performance the highest score followed by schedule performance, project quality, project output and observation variables as least performing.

These results mean that respondents monitored and evaluated cost performance best, followed by schedule performance, project quality, project output and observation variables (record keeping and pond security) in that order. Also see Figure 5.22 in Appendix VII)

4.3.4 PM&E Summary

A summary of the scores for both statistical and observation variables with respect to project location was computed to show the relative performance by respondents in PM&E as well as the variances for each PM&E factor (s^2) and for the aggregated PM&E scores (S^2).

Project Location/ Item	Project Quality	Cost Performance	Schedule Performance	Project Output	Observation Variables	Grand Total
Kikuyu	237.7	367.8	204.6	391.8	434.4	1892.2
Githunguri	273.6	352.8	163.8	362.4	315.0	1700.4
Lari	278.4	367.2	172.8	357.6	423.6	1846.2
Variance	495.5	72.1	459.5	342.8	4361.2	10030.0

Table 4.3.4: MCDA – PM&E Performance Summary

Based on project location, Kikuyu scores highest followed by Lari and Githunguri respectively. The variance scores are shown for each variable across the 102 respondents in column **(s^2)** and the variance for all scores for the 102 respondents **(S^2)** in table 4.3.4. The variance scores indicated in the table were used to calculate the Cronbach's Alpha that was used to illustrate the Kunder-Richardson Reliability Coefficient of Internal (KR_{20}) consistency for the psychometric instrument that was used to collect the data.

$$KR_{20} = \frac{(K)\,(S^2 - \sum s^2)}{(S^2)(K-1)} = \frac{21494.5}{40120} = \mathbf{0.536}$$

Where:

KR_{20} = Reliability Coefficient of Internal consistency. (0.536)

K = Number of items used to measure the concept. (5)

S^2 = Variance of all scores. (10030.0)

s^2 = Variance of individual items.

(495.5, 72.1, 459.5, 342.8, 4361.2)

Tabulating the summary results of the MCDA – Weighted Sum Model (Tables 4.3.1. to 4.3.6 in Appendix VII), we discuss the findings based on the statistical variables by project location as follows:

4.3.5 Specific Objective I: To determine whether adherence to operational compliance influences project sustainability.

This statistical variable, also known as Project Quality (A_1) in the study, measured the conformity by the project manager to the technical guidelines of project implementation as stipulated by the fisheries extension service. These guidelines focused on pond aquaculture. The Attributes examined under this variable included the challenge of maintaining water quantity versus water quality; reputability of the source of fingerlings; feed quality and availability; frequency and reason for sampling; marketing strategy; availability of market and project contact with the Fisheries extension service.

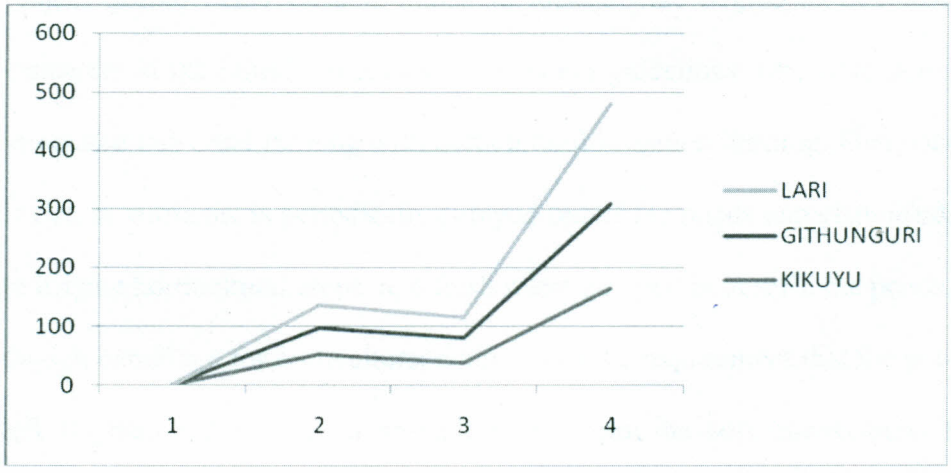

Figure 4.3.5: MCDA: Project Quality – Performance by Project Location

Lari district performed best among the three project locations with a score of 525.00 while Kikuyu performed worst (489.14). (See table 4.3.5a in Appendix VII). Findings indicate that most of the farmers in Lari were among the first adopters, when the project

was launched in 2008/2009. (See table 4.10.2) The fish ponds in Lari are earthen and instances of seepage were few, thus maintaining water quality.

In Kikuyu most of the farmers adopted the project in 2010/2011, the second phase of the project. In this project area, all the ponds in the survey are lined apart from a few in Dagoretti and Wangige areas which are earthen and situated along the rivers. A good number of farmers were experiencing challenges with leaking liners and this necessitated sustained topping up to maintain water quantity while seepage depleted the pond of vital nutrients for the fish.

Due to the innovative nature of some farmers in Kikuyu, there is evidence of emerging systems of integrated fish farming that do not necessarily conform to the conservative implementation guidelines that were specific to the project, hence scoring poorly in project quality. This variable aimed to measure the degree of compliance by project managers to the initial project implementation guidelines. One new farming system has integrated fish pond farming with horticultural irrigation farming. Fish pond water, which is rich in nutrients, is periodically pumped out of the ponds and channeled into the farms to irrigate horticultural crops, and fresh water pumped in to refill the ponds. This practice, though beneficial for horticulture, contravenes the requirement that the pond water is best left stagnant for as long as possible to maintain the best environment for the fish to flourish.

Another new system entails rearing the fish in greenhouses where the temperatures can be maintained at a higher level than that of the environment in order to boost the growth rate of the fish, hence maximizing productivity. The third practice that is emerging entails

intercropping tilapia and catfish where the latter serves as a means of biological control to keep the tilapia from overpopulation by feeding on the fingerlings, thus enhancing growth rate.

$H_0$1: Project Quality does not influence project sustainability.

The null hypothesis was upheld since Kikuyu which had scored worst in Project Quality scored best in sustainability practices. (Refer to table 4.10.2). This implies that Project Quality is not significant to Project Sustainability.

4.3.6 Specific Objective II: To find out how the average project cost influences project sustainability.

Average project cost, also referred to as Cost Performance (A_2), is the measure of the actual project implementation cost relative to the expected (planned) cost. The variable is measured through attributes such as the cost of maintaining the water in the fish ponds; the feeding cost from stocking to first harvest; marketing and labour costs.

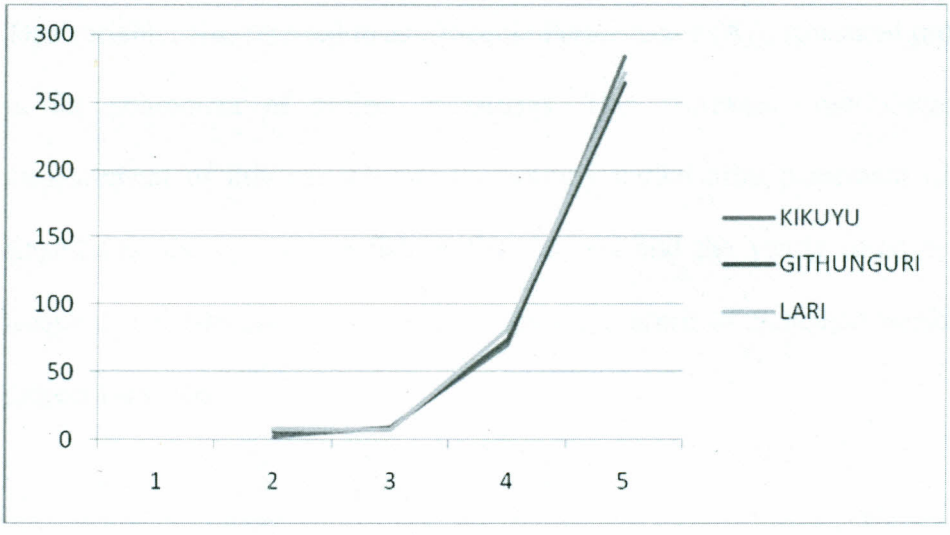

Figure 4.3.6: MCDA – Cost Performance by Project Location

Findings indicate that there was not much difference in the three project locations although Githunguri performed very slightly below the other two districts (367.80, 352.80 and 367.20 for Kikuyu, Githunguri and Lari respectively, See table 4.3.5a in Appendix VII).

This implies that the farmers in all the three project locations make similar decisions when considering implementation of project activities. The rates and costs may be fairly homogeneous given that the three project locations are in the same county.

$H_0$2: Average Project Cost (A_2) incurred by the project manager does not influence project sustainability in pond aquaculture.

The null hypothesis was upheld because in spite of there being no significant difference in average cost incurred in project implementation in the three project locations, the levels of sustainability for the locations differ considerably (Refer to Table 4.10.2).

4.3.7 Specific Objective III: To examine how project timeliness influences sustainability of the fish pond projects.

This variable, also referred to as Schedule Performance (A_3), measured project timeliness in the attainment of project milestones. The Attributes contributing towards the measurement of this variable are the waiting period after placement of the order for fingerlings; the age of the fish at first harvest and the yearly turnover based on the frequency of harvests. Figure 4.3.8 shows the score of Schedule performance across project locations.

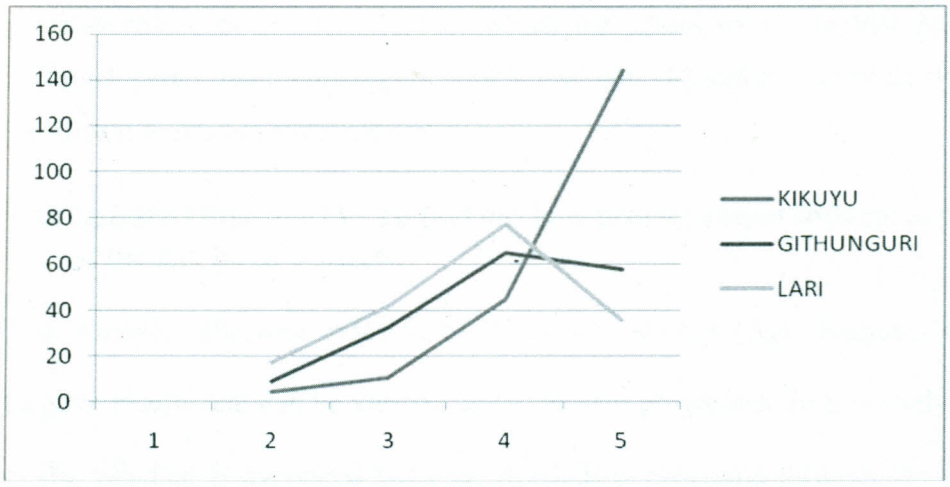

Figure 4.3.7: MCDA – Schedule Performance by Project Location

Kikuyu performed best (204.60), in that on average, the farmers have innovated new systems of fish farming geared to boost turnover; harvest their fish on a regular quarterly basis, and minimize losses to predators, unlike the farmers in Lari (172.80) who generally harvest twice a year and have not put measures in place to curb predators. In Githunguri, the second most critical challenge to the farmers was attainment of the market weight and farmers had not established a regular interval between harvests, hence performing worst (163.80) among the three in absolute values. (See table 4.3.5a in Appendix VII)

This implies that minimizing loses to predators as well as establishing a regular harvesting schedule will boost the turnover from the ponds because the farmer would be able to predict the expected output based on the previous harvests, all inputs maintained at constant level.

$H_0$3: Schedule Performance (A_3) does not influence project sustainability of the fish pond projects.

. The null hypothesis has been rejected because it is evident that schedule performance is significant to sustainability. Though Lari and Githunguri both did not have measures in

place to ensure pond security, Lari which has established a regular harvest schedule performs better than Githunguri which has not. Therefore Schedule Performance is significant to project sustainability.

4.3.8 Specific Objective IV: To find out how project output influences sustainability of the fish pond projects.

This variable otherwise referred to as Project Output (A_4), measures the immediate tangible results that can be verified as the project progresses. In this study it is the value of the fish that is harvested from the pond. It is measured through the initial stock of fingerlings in the fish pond; the proportion of the initial stock that is sold per year; the average weight of the fish in grams at harvest; the price the fish is fetching on the market; the target market; distance from farm to market and the degree of domestic consumption on the farm.

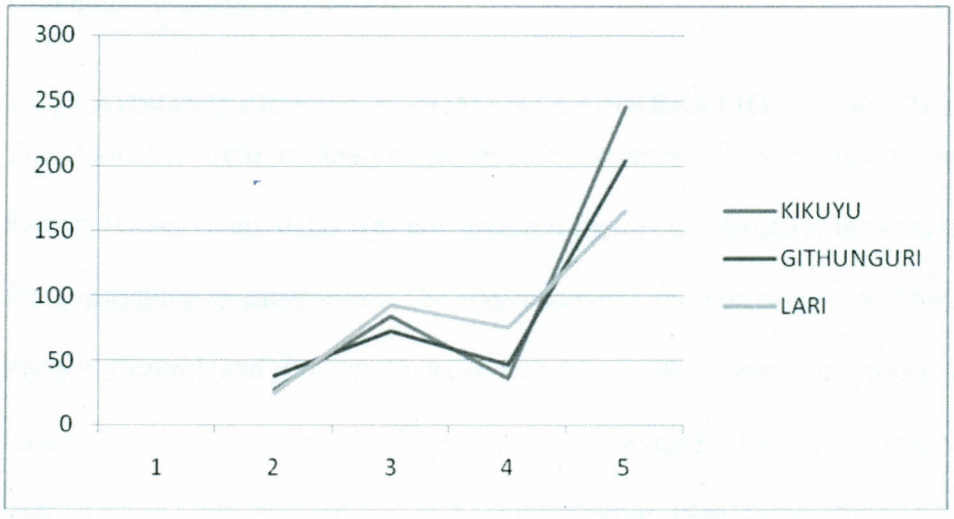

Figure 4.3.8: MCDA – Project Output by Project Location

Kikuyu (391.80) performed better than Githunguri (362.40) and Lari (357.60) (See Table 4.3.5b in Appendix VII). This is because the farmers in this Kikuyu harvest relatively more frequently and the fish also fetched better prices. Lari has the lowest score because

most farmers harvest twice in a year on average compared to Kikuyu which does it four times, but obtaining better market weights because of the relatively longer waiting period. Githunguri, though it does not harvest at regular intervals due to difficulty in attaining market weight scores better in this variable than Lari which harvests only twice a year. This implies that all other parameters held constant, more harvests yield relatively more stock that is available for sale at whatever cost and also reduces the losses that farmers incur owing to predators.

H_0:4 Project Output (A_4) does not influence project sustainability of the fish pond projects.

The null hypothesis has been rejected since more harvests mean more stock sold per year and this increases the value of the annual output for the farmer as is the case for Githunguri when compared with Lari.

4.4 PEARSON'S PRODUCT MOMENT CORRELATION COEFFICIENT

This tool was used to analyze parametric variables. Project Quality and Intervening Factors (Observation data) was not analyzed by this tool because the data collected under these variables is categorical. The tool examines the correlation relationships between Project Control and Project Success variables with respect to Project Sustainability. Under Project Control we analyzed Cost performance while under Project Success we analyzed Schedule Performance and Project Output. (See Tables 4.4.1, 4.4.2 and 4.4.3 in Appendix VIII) This means that this tool was used to analyze relationships among the indicators in specific objectives II, II and IV, and indicators in project sustainability, which are average harvest weight, price offered on the market per kilogramme and sales per year.

4.4.1 Specific Objective II: Correlations between Cost Performance and Project Sustainability

The marketing cost correlates negatively with average price offered per kg on the market, average weight at harvest and proportionate stock sold per year (0.05 significance level, -0.214, -0.236 and -0.233). The relative production cost at harvesting (man days) is positively correlated with proportionate stock sold per year (0.01 significance, 0.255), probably due to the increasing the effectiveness of each harvest and hence, sales. (Refer to Table 4.4.1 in Appendix VIII).

This implies that a farmer incurs increasing marketing cost as the price offered on the market deceases, which in turn depends on decreasing harvest weight. It would be more profitable to limit the marketing cost (cooling, packaging and transport, and) as much as possible for the benefit of the production cost (harvesting), so as not to compromise the effectiveness of the harvest, in order to enhance project sustainability. Limiting the marketing cost can be realized by selling as much of the fish as possible at farm gate or limiting the distance from the farm to the target market.

4.4.2 Specific Objective III: Correlations between Schedule Performance and Project Sustainability

Reference to table 4.4.2 in Appendix VIII indicates that there is a negative correlation between the age in months at first harvest and the proportionate stock sold per year (0.05 significance, -0.201). This is a pointer to the fact that predators compete for the same stock that would otherwise be sold. The age of fish at harvest correlates positively with the initial stock of fingerlings (0.01 significance, 0.274) but does not affect the market price. The age at harvest increases with increasing initial stock of fingerlings because of increasing competition for feed, air and space in the pond, which slows down the growth

rate. Market price is based on the weight at harvest regardless of age of the fish. The frequency of harvests neither affects the proportionate stock of fish sold nor the prices that the fish attracts on the market.

It would enhance sustainability of the projects if the farmer would harvest regularly at the earliest opportunity to avoid losing a lot of fish stock to predators. Regular sampling to reveal the fish size and population becomes necessary in order to know when to harvest. This should also help to keep the fish population under control because overpopulation retards the growth rate of the fish, delaying attainment of market weight and increasing the cost of production.

4.4.3 Specific Objective IV: Correlations between Project Output and Project Sustainability

The initial stock of fingerlings correlates negatively with the proportionate stock sold per year. The average weight at harvest correlates positively with proportionate stock sold per year (0.01 significance, 0.274), and average price offered by the market per kilogramme of fish (0.05 significance, 0.255). Market availability is enhanced by increasing fish size (Refer to table 4.4.3 in Appendix VIII).

While fish size seemed to be the main determinant for demand from the market, the challenge farmers faced is the slow growth of the stock together with the increasing threat of predators which are also attracted more to the increasing size of the fish. The farmer would best strike a balance between waiting longer to have the fish grow bigger, and losing more fish to predators. The latter can be eliminated by investing in appropriate pond security measures which many of the farmers did not consider a priority; and well-timed regular harvests which are determined by sampling.

4.5 CHI-SQUARE TEST

4.5.1 Specific Objective I: Project Quality and Project Sustainability

This variable was analyzed with respect to project sustainability and project location. Baseline factors included top-up to maintain water quantity and quality, ease of finding feed for the fish, ease of finding market for the fish, frequency of sampling per year, reason for sampling and fisheries extension services. (See table 4.5.2 in appendix IX)

$H_0$1a: Project Quality is not significant to project location.

In maintenance of water quantity and quality there are contrasts between Lari and Githunguri versus Kikuyu whereby Lari and Githunguri have complied (44.1% for both locations) with the requirement that stagnant water offers the best quality for fish farming while Kikuyu, which scores worst at 32.4% has most of its ponds with water flowing continuously or is changed periodically. Majority of farmers in Lari (79.4%) do not sample while 64.7% of those in Kikuyu sample to check the size of fish. in ease of finding market, Lari scores highest at 79.4% but Kikuyu is lowest with 32.4%. At the stage of project initiation when the pond was being dug, extension services were available to the three project locations in fairly equal measure (29.4%, 26.5% and 26.5%). During the ensuing project phases, extension services became available to Kikuyu at 17.6% and to Githunguri and Lari at 73.6% and 70.5% respectively.

There was a significant difference in the project quality with respect to project location for extension services, finding a market, reasons for sampling, frequency of sampling, finding feeds and water quality (P-value < 0.05). (See table 4.5.2 in Appendix IX). Therefore the null hypothesis ($H_0$1a) is rejected. Project Quality is significant to project location.

$H_0$1b: Project Quality is not significant to project sustainability.

Reference to table 4.10.2 shows that Kikuyu scores highest (73.5%) followed by Githunguri (70.6%) and Lari (52.9%) in sustainability practices while results in table 4.5.3a indicate that by summary, Kikuyu scores worst in Project Quality (489.14), Githunguri (506.40) and the best location is Lari (525.00).

Kikuyu, scored worst in Project Quality but leads in sustainability practices, while Lari which scored best in Project Quality performs worst in sustainability practices. (See Table 4.3.5a in appendix VII).

The null hypothesis ($H_0$1b) is upheld because Project Quality which measured conformity by the project manager to the technical guidelines of project implementation was not significant to sustainability, determined by the level at which a project location undertakes sustainability practices.

4.5.2 Specific Objective II: Cost Performance and Project Sustainability

This variable was analyzed with respect to project sustainability and project location. Baseline factors analyzed under this variable included cost of re-filling the pond per year, marketing cost and production cost (pond cleaning and harvesting) (See table 4.5.3 in Appendix IX). Results in table 4.3.5a in Appendix VII show that Kikuyu, Githunguri and Lari scored almost uniformly (367.80, 352.80 and 367.20 respectively).

$H_0$2a: Cost Performance is not significant to project location.

Figure 4.3.7 shows that here was no difference in Cost Performance in the three project locations while none of the baseline factors under this variable were found to be significant with respect to project location. (P-value > 0.05) (See table 4.5.3 in Appendix

IX). The null hypothesis ($H_0$2a) is therefore upheld. Cost Performance was not significant to project location.

$H_0$2b: Cost Performance is not significant to project sustainability.

The null hypothesis was upheld because in spite of there being no significant difference in average cost incurred in project implementation in the three project locations, the levels of sustainability for the locations differ considerably (Refer to Tables 4.10.2 and 4.5.3 (in Appendix IX)). Therefore, Cost Performance is not significant to project sustainability.

4.5.3 Specific Objective III: Schedule Performance and Project Sustainability

The baseline factors namely, the waiting period after placement of the order for fingerlings, age of fish at first harvest and number of harvests per year were all found to be significant with respect to project location. (See table 4.5.4 in Appendix IX).

For the longest waiting period of 5 to 6 weeks, Lari had the largest majority (47.1%) and Kikuyu the least (5.9%) while the shortest waiting period (below 1 week) had a majority of respondents from Kikuyu (70.6%). The highest age of fish in months at harvest (18 months and above) is most prevalent in Lari (32.4%) and least in Githunguri (2.9%), while the lowest age (below 10 months) at harvest was predominant in Kikuyu (58.8%) and least in Lari (17.6%). Majority (47.1%) of farmers in Kikuyu harvest 4 times a year, in Githunguri, the majority (38.2%) harvest 3 times while in Lari, most (58.8%) of them harvest 2 times a year.

$H_0$3a: Schedule Performance is not significant to project location.

Majority of the farmers in Kikuyu wait for the shortest time (below 1 week) to stock their ponds, attain the shortest time to harvest (below 10 months) and harvest four times in a year while the majority for Lari wait for the longest time to stock their ponds (5 to 6 weeks), attain harvest weight after the longest period of time (32.4%) and harvest only twice annually. The p-value for all the baseline factors that were examined under this variable was less than 0.05. The null hypothesis ($H_0$3a) is therefore rejected. Schedule Performance is significant to project location.

$H_0$3b: Schedule Performance is not significant to project sustainability.

Based on the results from table 4.5.4 in Appendix IX, Kikuyu scores highest in the three parameters of the waiting for stock period, attainment of market weight and frequency of harvests per year. This means Kikuyu farmers lose relatively least time before stocking, have a relatively higher growth rate for their fish on average and harvest more frequently, boosting turn-over and hence sales. The case for Lari farmers is a contrast to the same. Table 4.10.2 echoes the trend by showing that Kikuyu (73.5%) scores best in sustainable practices while Lari (52.9%) scores least. The null hypothesis ($H_0$3b) is rejected. Therefore Schedule Performance is significant to project sustainability.

4.5.4 Specific Objective IV: Project Output and Project Sustainability

The baseline factors for this variable included initial stock of fingerlings, proportionate stock sold per year, average harvest weight, average price offered per kilogram, target market for the fish, distance from the market and estimated quantity of fish consumed on the farm per year.

$H_0$4a: Project Output is not significant to project location.

Initial stock of fingerlings ranged from 100 to 1000, delivered in batches of approximately 250. Kikuyu had 91.2% of its farmers get 750 to 1,000 fingerlings as initial stock, Githunguri (82.4%) and Lari (29.4%). For the category which received the least (350 to 549) fingerlings as the initial stock, Kikuyu (2.9%), Githunguri (17.6%) and Lari (55.9%). Proportionate stock sold per year, Kikuyu (73.5%), Githunguri (26.5%) and Lari (58.8%) harvested 26% to 50% of their initial stock. Githunguri had the majority of farmers harvesting 1% to 25% of their initial stock. The average harvest weight was 251g to 500g which had been attained at 67.6% of farmers in Kikuyu and 79.4% of farmers for both Githunguri and Lari.

Only Kikuyu farmers (2.9%) had attained harvest weight of 751g to 1,000g. None of the other two project locations had attained this harvest weight. The target market for the fish was the neighbourhood, mama samaki, fishmongers and hotels. Kikuyu (64.7%) and Githunguri (52.9%) farmers mainly targeted hotels while Lari (73.5%) targeted the neighbourhood. Domestic consumption was most prevalent in Lari (76.5%) followed by Kikuyu (61.8%) and Githunguri (50.0%). All these factors were found to be significant with respect to project location with the exception of distance from market. (P-value > 0.05) (See table 4.5.5 in Appendix IX). The null hypothesis is therefore rejected. Project output is significant to project location.

$H_0$4b: Project Output is not significant to project sustainability.

Kikuyu had the majority share of the largest batch of initial stock of fingerlings, attained the highest proportionate stock sold per year and highest harvest weight .Lari had the majority share of the smallest batch of initial stock of fingerlings, though it tied with Kikuyu in the category (26% to 50%) of proportionate stock sold per year, it did not

attain the 751g to 1000g harvest weight. Starting from relatively less initial stock this meant the turnover would be relatively less than that of Kikuyu. Results from table 4.10.2 indicate that Kikuyu scored better in sustainable practices, hence sustainability rating compared to Lari. The null hypothesis ($H_0$4b) is rejected. This means that project output is significant for project sustainability.

4.6 Backyard/Pond Aquaculture Project Control

Project Control according to this study, is aggregate of all the measures undertaken by the farmer to conform to the stipulated technical guidelines of project implementation while keeping the costs as close as possible to the expected level; with the objective of maximizing project economic sustainability.

4.7 Backyard/Pond Aquaculture Project Success

In this study, project success is the consequent ability of the project to produce timely, tangible results that can be verified as the project progresses, subject to the project control measures being instituted during implementation. It is the measure of project performance in terms of profitability, over and above the break-even point. Verification of the tangible results can only be obtained through sound record keeping, from which the productivity of the projects can be deduced.

4.8 The role of PM&E for sustainable fish production in backyard/pond aquaculture.

PM&E has two research variables namely Project Control and Project Success which interact to affect economic project sustainability. Project Control consists of two factors; Project Quality and Cost Performance, which are upstream project activities. They measure conformity to the technical guidelines of project implementation as stipulated by

FFEPP, and the cost incurred by the farmer in undertaking the same. The interaction of these two factors determines performance of Project Success.

Project Success measures the outcome of Project Control activities. Consisting of Schedule Performance and Project Output, it is considered as a measure of the performance of consequent (downstream) project activities that determine the value of the turnover that is realized from the project over time. There must be a balance between Project Control and Project Success for sustainable backyard/pond aquaculture production to be achieved.

4.9 Intervening Variables

The study listed socio-economic factors as an intervening variable and obtained data through an observation guide on two crucial factors. These are record-keeping by the respondents and pond security.

4.9.1 Record Keeping

Record keeping was found to exist in three forms in this study, namely non-existent, verbal and physical. Verbal records were either mental or inaccessible at the time of the survey. Physical records were those that were accessible and hence verifiable at the time of the survey. Attitude and consistency with respect to record keeping was also examined. Results from table 4.5.6a and 4.5.6b in Appendix IX are summarized in the tables 4.9a and 4.9b below:

Indicator	%Kikuyu	%Githunguri	%Lari	% Total
Evidence of Records (3)				
None-existent	46.07	37.23	30.40	37.91
Mental	20.57	44.13	12.77	25.82
Inaccessible	4.90	10.80	48.03	21.24
Accessible	28.43	7.83	8.83	15.03

Indicator	%Kikuyu	%Githunguri	%Lari	% Total
Consistency in Record-Keeping (3)				
None-existent	44.10	61.77	32.33	46.06
Initial Records Only	1.93	13.70	3.90	6.51
Partial Records	4.90	14.70	0.00	6.53
Up-to-Date Records	49.03	9.83	63.70	40.85
Attitude to Record Keeping				
Records not necessary	32.40	38.20	2.90	24.50
Records hard to keep	14.70	38.20	11.80	21.57
Records kept if time allows	29.40	17.60	73.50	40.17
Records critical and always kept	23.50	5.90	11.80	13.73

Table 4.9a: Summary of Record Keeping

4.9.1.1 Evidence of Records

The study considered the average score for three types of records (feeding, sampling and sales). Only 15.03% of the respondents in this study presented physical records that could be accessed for use to evaluate their projects. Kikuyu had the highest proportion of respondents (28.43%) in this category, followed by Lari and Githunguri in that order. Of all the respondents, 37.91% had not engaged in any form of record keeping; Kikuyu had the highest proportion (46.07%) of the same, followed by Githunguri and Lari respectively. Inaccessible records which were either mental or locked away at the time of the study accounted for 47.06% of the respondents.

The summary above implies that 63.05% of all accessible records were found in Kikuyu. The findings also show that Kikuyu has two contrasts of categories with respect to evidence of accessible records. The ratio of those with physical records to those with no form of record whatsoever is approximately, 5:8 for Kikuyu, while the same ratio to Lari and Githunguri is 5:19 and 5:27 respectively.

4.9.1.2 Consistency in Record-Keeping

The study also focused on the state of record-keeping through the life of the project. Under this indicator, records were found to be in any one of the four following states; none-existent, initial records only, partial records and up-to-date records. Out of the 102 respondents, 46.06% were found to have no consistent records at all, 6.51% presented initial records only, 6.53% had partial records and 40.85% presented up-to-date records, some of which were verbal. Githunguri led in relative proportion of those who did not have any consistent record-keeping (61.77%), followed by Kikuyu (44.10%) and Lari (23.33%) respectively. Lari performed best in consistent record-keeping (63.70%) followed by Kikuyu (49.03%) and Githunguri (9.83%) respectively.

These results indicate that in Kikuyu, 57.98% of the up-to-date records presented were accessed because they were available in physical form. Lari which scored best in consistent record-keeping presented 13.86% of the records physically. This means 86.14% of respondents in Lari had accurate and consistent institutional knowledge about their project life but no physical records. This would pose a challenge to PM&E as the projects continue running because institutional knowledge that is stored in memory is lost as time goes on. Githunguri fared worst with 9.83% of its respondents presenting up-to-date records, presumably because their second most critical challenge according to the study, was attainment of market weight (see table 4.2.6) and a regular schedule of harvests had not been established by the time of the study.

4.9.2 Pond Security

Indicator	%Kikuyu	%Githunguri	%Lari	% Total
Pond Security (Perimeter fencing)				
None-existent	20.60	91.20	76.50	62.77
Partially secured	20.60	2.90	2.90	7.84
Secured but needs reinforcement	26.50	2.90	5.90	11.77
Fully secured	32.4	2.90	14.70	13.73
Pond Security (Overhead fencing)				
None-existent	64.70	91.20	94.10	83.33
Partially secured	5.90	5.90	0.00	3.93
Secured but needs reinforcement	11.80	0.00	0.00	3.93
Fully secured	17.60	2.90	5.90	6.85

Table 4.9b: Summary of Pond Security

The study found that there were two types of ponds in existence, as well as green-houses. Lined ponds, had been dug near the homesteads, and lined with heavy duty polythene material to prevent seepage of the water from the pond. Lined ponds were found predominantly in Kikuyu but most of the earthen ponds were found in Githunguri and Lari. Table 4.9b summarizes the results: Earthen ponds had been dug away from the homesteads in valleys, near rivers but had no liners.

Pond security was considered from two perspectives; Perimeter and Overhead pond security. Perimeter security concerned fencing the pond area in such a way that terrestrial predators such as man, frogs and dogs among others are kept out of bounds. Overhead pond security entailed putting a canopy of strings or mesh over the ponds to keep birds and all flying predators off the ponds. Pond security was found to be non-existent, partially secured, secured but needing reinforcement or fully secured.

4.9.2.1 Perimeter Fencing

The study found that 62.77% of all respondents had no perimeter fencing. Githunguri had the highest proportion of respondents in this category (91.20%) followed by Lari (76.50%) and Kikuyu (20.60%). Only 13.73% of all respondents had fully secured the perimeter of their ponds against terrestrial predators. Kikuyu scored the best (32.4%) in relative terms, followed by Lari (14.70%) and Githunguri (2.90%).

Almost all lined ponds were found in Kikuyu. Such ponds being dug within or close to the homestead may have drawn the attention of the project managers to the challenge of predators, hence the effort to improve on pond security in general. This is not the case with earthen ponds which are situated on the lowest part of the farms, away from the homestead, near the rivers.

4.9.2.2 Overhead Fencing

Of the 102 respondents, 83.33% had ponds without any form of overhead fencing. Lari and Githunguri had 94.10% and 91.20% of their respondents in this group. Only 6.85% of the 102 respondents had fully secured their ponds against predators. Kikuyu which had respondents that were more aware about losses of stock to flying predators also had only 17.60% of those who had fully secured their ponds. Githunguri and Lari had 2.90% and 5.90% of respondents in this category, respectively.

It is notable that entire project locations of Lari, Githunguri and some parts of Kikuyu had earthen ponds and pond security did not appear to be a priority to the farmers. It is also significant that pond security demands extra cost if it must be put in place. Some respondents also, were not aware that they could be losing fish stock to predators and hence; did not consider it a necessity to enhance pond security.

4.9.2.3 Record Keeping and Pond Security

The study found that the combined effect of the intervening/observation variables (Record-keeping and Pond Security) is significant to PM&E performance and project location. (See and compare Figures 4.9.2 and 5.2.2 in Appendix IX)

This implies that the performance of the FFEPP as a project must focus on innovative ways to motivate record keeping at farm level, in forms that can be retrieved for evaluation on project performance over time. FFEPP should incorporate into its grant for pond construction, an element of pond security so that project output is enhanced and this would have a positive impact on sustainability.

Analysis of the data generated through observation indicated that Kikuyu performed better in record keeping and pond security in general, followed by Lari and Githunguri respectively. This translated into the same order of overall performance as indicated by the total score in table 4.8; showing that record keeping and pond security are intervening factors that contribute significantly to project success, and hence, sustainability. The sub-total that is indicated in table 4.3.5b represented the project performance without taking into consideration the effect of the intervening variables. The grand total gives the overall score for which the intervening variable has been controlled.

Bio data is also part and intervening factors. It consists of respondent's gender; respondent's link to project owner, respondent's age and formal education level.

Observed evidence of feeding and sales records was significant to project location (p-value <0.05) but this was not the case with sampling records. Observed consistency in record keeping and attitude towards record keeping was found to be significant to project

location (p-value <0.05). Pond Security was found to be significant to project location. (See Table 4.5.6 in Appendix VII)

The cut-off volume for stock of fish sold per pond per year relative to the initial stock was up to three quarters. The cut-off range for the average weight of fish, 250 to 499 grams while the cut-off range for the market price of the fish was 300/= to 450/=.

These cut-off parameters were used to examine the proportion of farmers that were operating their projects at a level that can be considered economically sustainable.

4.10 Sustainability Practices

These were project activities that when undertaken at certain levels, guaranteed economic sustainability of the projects according to the study. These activities were proportionate stock sold per year, minimum at three quarters of the initial stock; average price offered on the market, the minimum being Sh. 300 per Kg; and average harvest weight, minimum at 250 grams. For a project to be considered sustainable, all these three practices had to be fulfilled at the minimum cut-off levels and above. (Refer to table 4.10 in Appendix VII)

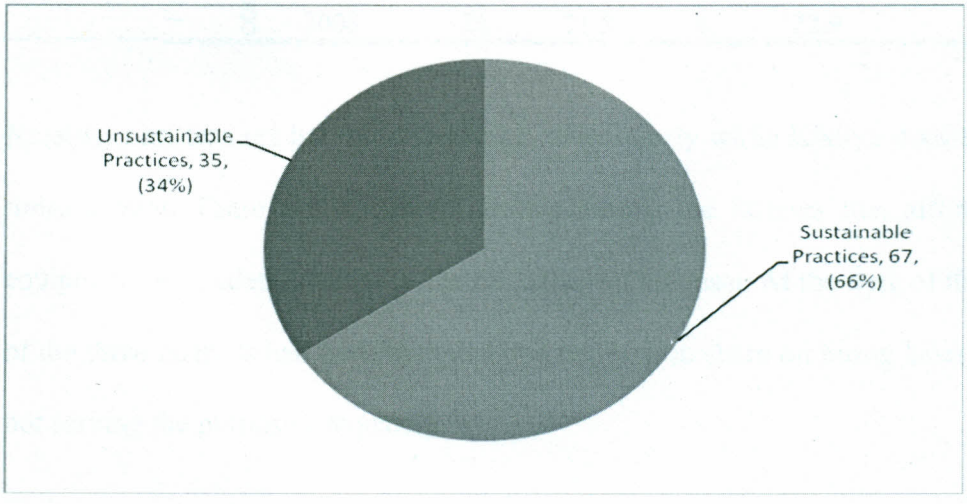

Figure 4.10.1: Chi-Square - Sustainability Practices

Results indicate that 66% of the projects in the study are operating at a level that can be economically sustainable. The remaining 34% are not. The FFEPP has significant potential to meet the goal of economic sustainability if the intervening variables being the can be taken into account and addressed accordingly.

The findings also show that Kikuyu performs best in sustainability practices (73.3%) followed by Githunguri (70.6%) and while Lari (52.9%) respectively (See table 4.10.2).

Table 4.10.2: Sustainability Practices by Project Location & Year of Commencement

	Project Location (District)					
	Kikuyu		Githunguri		Lari	
	Freq.	%	Freq.	%	Freq.	%
Sustainable Practices						
Yes	25	73.5	24	70.6	18	52.9
No	9	26.5	10	29.4	16	47.1

		Sustainable Practices			
		Yes		No	
		Freq.	%	Freq.	%
Project year of commencement	2011	13	19.4	15	42.9
	2010	32	47.8	11	31.4
	2009	1	1.5	1	2.9
	2008	21	31.3	8	22.9

Notably, Lari farmers harvest on average, twice yearly while Kikuyu does the same four times a year. There was a general feeling among the farmers that affordable fishing equipment be availed to enhance the frequency of harvests. At the time of the study, each of the three districts had been assigned one net each to share on hiring basis and this was not serving the purpose adequately.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter consists of the summary of results, conclusion and recommendations.

5.2 Summary of the findings

According to the study Project Quality entailed adherence to project implementation guidelines. Though significant to project location, it did not necessarily influence project sustainability because farmers, especially in Kikuyu, had devised innovative ways to enhance economic sustainability in a manner that was not prescribed in the original project implementation guidelines and performed better than their counterparts in other project areas who scored a higher rating in Project Quality.

Project Cost for marketing activities correlated negatively with sustainability factors while Project Cost for production activities enhanced factors related to sustainability. Project cost in general was neither significant to project location nor to project sustainability. This could indicate that the farmers in all the three project locations make similar decisions when considering implementation of project activities. The rates and costs may be fairly homogeneous given that the three project locations are in the same county.

Kikuyu performed best in Schedule Performance specifically due to the established pattern of regular harvests, more frequent than that of Lari and Githunguri. Farmers in Kikuyu have lined ponds that are located within the homestead. They are bound to be more aware of predators by virtue of their proximity to the ponds. Conscious of the fact that predators are also competing for the fish, these farmers tended to harvest more

frequently than farmers in the other project locations, whose ponds are situated along the rivers, away from the homesteads, hence scoring a higher rating on turnover, based on frequency of harvests. The age at harvest correlates positively with the initial stock of fingerlings and proportionate stock sold per year. The market price however, is based on the weight of the fish at harvest regardless of the age.

To boost Project Output, there are innovative integrated fish farming systems emerging in Kikuyu. Intercropping some catfish with the tilapia to control fingerling populations thereby reducing competition for air, feed and space to boost growth rate and green house fish farming under controlled temperatures, also to boost growth rate are examples. Coupled with the frequent harvests at regular intervals, this has made Kikuyu perform better than Lari and Githunguri.

5.3 Conclusions

Innovations in project implementation can prove better than stipulated guidelines and room for innovation boosts sustainability of projects. Based on the findings on performance of PM&E in figure 5.2.1 (Appendix VII), Kikuyu has performed best in Schedule Performance, Project Output and Observation variables and is hence considered to lead in Project Sustainability practices in pond aquaculture in Kiambu County. This fact is highlighted by Figure 5.2.2 (Appendix VII), which shows that in overall performance based on project location, Kikuyu performs best.

According to the Implementation Guidelines for FFEPP, 2010/2011, first phase of the Fish Enterprise Productivity Programme (FFEPP) was initiated in 2008/2009 and ended in the 2009/2010 fiscal year. Phase II of the project is expected to be implemented within the 2010/2011 fiscal year. Table 4.2.4 which illustrates Project age and corresponding

frequency of respondents shows that the trend is upward with respect to the number of farmers adopting the aquaculture project with time. Disbursement of funds seems to have been done at the beginning of the first phase, hence the spike in the year 2008. The project's second phase began in 2010/2011 and hence the second spike in 2010 corresponding to increased project entrants, which is higher than in 2008 when the project was initiated in the first phase.

Reference to Figure 5.2.3 (Appendix VII) shows that the PM&E factor which was best undertaken by the respondents is Cost Performance. The respondents across the three project locations uniformly monitor Project Cost more than the other PM&E variables of Project Quality, Schedule Performance and Project Output. It is logical to conclude that these farmers are entrepreneurial in nature and aim to undertake the aquaculture projects for commercial purposes, minimizing cost to maximize profitability.

Reference to table 4.2.6 indicates that finding market is the second most critical challenge that the farmers are experiencing. Establishment of market infrastructure would go a long way in enhancing sustainability of the projects.

5.3.1 Logistic Regression - Modeling factors Affecting Sustainability with Intervening factors

The baseline factors of gender, project manager's status, project manager's age, project manager's formal education level, project age and project location were analyzed for significance to project sustainability. Since non-of the factors were significant (Univariately) the factor with the largest chi-square value in each category was used in the model. (See Table 5.3 1 in Appendix IX)

Only Project Manager's age and Project Location were significantly associated with the sustainability of the fish farming (p value<0.05).

For Project Manager's age, with every additional increase in age (in years) the likelihood of a fish farming being sustainable increases by 1.2 times (p value = 0.018). Kikuyu and Githunguri had 20% high chances of having sustainable fish farming compared to Githunguri (p value <0.05).

5.4 Recommendations

5.4.1 Government Policy

While every project has stipulated guidelines on implementation, farmers' innovations as they experiment in the implementation of the projects must be evaluated and documented to reveal emerging farming systems that will be used as blueprints for future projects.

5.4.2 Private Sector Participation

The upward trend in adoption of the fish project with time, calls for the establishment of market infrastructure such as cooling facilities, water, electricity and reliable marketing system that will be effective in holding, preserving and conveying the fish to the market to maintain a steady supply. Collaborative efforts between government and other stakeholders can consolidate efforts in the areas of community mobilization, consistent farmer training to keep abreast with the emerging technology in aquaculture, extension services, credit facilities, provision of affordable fishing equipment, processing and marketing.

Record keeping in forms that can be accessed years on in the life of a project ought to be strengthened if sustainability of the projects is to be monitored and evaluated.

Many farmers considered pond security an extra expense. Awareness about the magnitude of the loss of fish stock to predators is scanty. The fish farmers must be sensitized on this fact and how to curb it since it impacts on sustainability. Pond Security must be enhanced especially for the earthen ponds that are situated far from homesteads in order to realize bigger harvests.

5.5 Future Research

Project sustainability is more complex than economic sustainability alone. Other aspects critical to project sustainability include the political, socio-cultural, technological, environmental, demographic and legal conditions that all contribute to project sustainability in one way or another. Further research would take one or more of these aspects to explore their influence on project sustainability.

The parameters chosen to measure the variables are subjective and more research would reveal other indicators that can be used to measure these research variables. Researchers can explore why PM&E is undertaken differently by various project participants. They can also explore through further research, which other factors can be aggregated to form PM&E and what other tools and techniques to use in analysis PM&E.

The intervening variables (Pond Security and Record Keeping) were found to have a significant influence on sustainability and more studies would be required to investigate the possible causes of non-adoption of these by farmers.

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APPENDICES

Appendix I: **INTERVIEW SCHEDULE**

1 PERSONAL DATA

a) **Telephone/Cell Phone number**: (Optional)

b) **Gender** (Tick One):

Male		Female	

c) **Project Manager's status** (Tick One):

Volunteer		Employee	
Relative		Owner	

d) **Project Manager's Age Bracket in years** (Tick One):

16 to 30		46 to 60	
31 to 45		61 and above	

e) **Project Manager's Formal Education Level** (Tick One):

None		Secondary School	
Primary School		Post Secondary School	

f) **Project Category /Age** (Year of Project Commencement) (Tick One)

2011		2009	
2010		2008	

g) Project Location (District) (Tick One):

Kikuyu		Lari	
Githunguri			

h) Rank the challenges (1-5) beginning with the most critical.

Leaking Liner	
Lack of technical follow up	
Fish Size at harvest	

Predators	
Finding the Market	

2 **PROJECT QUALITY** (Tick One to answer each question)

a) How often do you top up the pond to maintain water quality and quantity?

Continuous flow through the pond	
When the level goes down.	

Quarterly	
Never	

b) Where did you buy your last batch of fingerlings?

A hawker	
My other pond	

Another farmer
Sagana/GOK

c) What is the main feed for your fish?

Greens	
Anything	

Bran and Maize germ	
Fish Pellets	

d) How easily do you find the feeds to buy for the fish?

Not easily	
Fairly easily	

Easily	
Very easily	

e) How often do you do sampling in the pond?

Never	
Once at any time	

Every 6 months	
Quarterly.	

f) Why do you do sampling in the pond?

I don't sample		To check the size of fish	
I don't know		To estimate the pond population.	

g) What did you do with most of the fish you harvested last time?

Gave it away as gifts.		Neighbours came to buy it.	
Consumed it in the family.		It was bought in bulk on order.	

h) How easily do you find market for your fish?

Not easily		Easily	
Fairly easily		Very easily	

i) When has your farm been visited by fisheries extension officers?

Never.		During harvesting.	
When the pond was being dug.		Every three months or on demand.	

3 **COST PERFORMANCE** (Tick One to answer each question)

a) How many times do you drain the pond to refill with fresh water in one year?

Three times or more		Once	
Twice		No time	

b) What is the average cost of feeding the fish in one pond until you begin to harvest?

Above 6,000/=		3,000/= to 4,500/=	
4,501/= to 6,000/=		Below 3,000/=	

c) How much does it cost you to take the fish to the market after harvest?

Above 1,200/=		1/= to 599/=	
600/= to 1,200/=		0/=	

d) How many workers do you use to clean one fish pond in one day?

10 and Above		4 to 6 Workers	
7 to 9 workers		1 to 3 Workers	

e) How many workers do you use to harvest in one pond at any one time?

10 and Above		4 to 6 Workers	
7 to 9 workers		1 to 3 Workers	

4 <u>SCHEDULE PERFORMANCE</u> (Tick One to answer each question)

a) How long did you wait for fingerlings after you placed the order?

5 to 6 weeks		1 to 2 weeks	
3 to 4 weeks		Below 1 week	

b) At what age was the first harvest of fish?

18 and Above		10 to 13 months	
14 to 17 months		Below 10 months	

c) How many times do you harvest in one fish pond per year including the first harvest?

1		3	
2		4	

5 **PROJECT OUTPUT** (Tick One to answer each question)

a) What was the initial stock of fingerlings per pond?

100 to 349		550 to 749	
350 to 549		750 to 1000	

b) How much of the initial stock of fish do you sell per pond in a year?

Up to 25%		Up to 75%	
Up to 50%		Up to 100% and over	

c) What was the average weight of fish in grams at last harvest?

1g to 250g		501g to 750g.	
251g to 500g		751g to 1,000g	

d) How much are you paid for your fish per kilogram?

201/= to 300/=		401/= to 500/=	
301/= to 400/=		501/= to 600/=	

e) What is your main target market for the fish?

Neighbourhood		Fishmongers (Butcheries)	
Mama Samaki (Fryers)		Hotels	

f) How far is your target market from the farm?

22Km or more		8Km to 14Km	
15Km to 21Km		0Km to 7Km	

g) About how much of the fish do you eat on the farm in one year?

Over 100 pieces.		31 and 70 pieces.	
71 to 100 pieces.		30 pieces and below.	

Appendix II: OBSERVATION GUIDE

1. Evidence of Records (If any) (Tick Appropriately)

Recording & Records	**None - existent = 1**	**Verbal Presentation** (mental records) **= 2**	**Verbal Presentation** (inaccessible records) **= 3**	**Physical presentation of records = 4**
Feeds and Feeding				
Sampling				
Sales				

2. Consistency of Record Keeping throughout the project life. (Tick Appropriately)

Recording & Records	**None– existent = 1**	**Initial Records only = 2**	**Partial Records = 3**	**Up to date records = 4**
Feeds and Feeding				
Sampling				
Sales				

3. Attitude to Record-keeping (Tick Appropriately)

Status	**Records are not necessary = 1**	**Records are necessary but too hard to keep = 2**	**Records are necessary but kept when time allows = 3**	**Records are critical and always kept = 4**
Attitude				

4. Pond Security. (Tick Appropriately)

Status	**None– existent = 1**	**Partially secured = 2**	**Secured but needs Reinforcement = 3**	**Fully secured = 4**
Perimeter Fence				
Overhead Pond Fencing				

Appendix III: CODE BOOK

Personal Data			
Indicator	**Attributes**	**Measurements**	**Scales**
Gender	Male, Female	Frequency Distributions.	**1** = Male **2** = Female
Manager's Status	Owner, Relative, Employee	Frequency Distributions.	**1** = Volunteer **2**= Relative **3** = Employee **4** = Owner
Manager's Age	Age in years	Central Tendency and Frequency Distributions.	**1** = (16 to 30 years) **2** = (31 to 45 years) **3** = (46 to 60 years) **4** = (61 and above) years
Manager's Level of Education	Highest level attained	Frequency Distributions.	**1** = None **2** = Primary School **3** = Secondary School **4** = Post Secondary School
Project Category	Project age in years	Central Tendency and Frequency Distributions.	**1** = 2010 **2** = 2009 **3** = 2008
Project Location	District	Central Tendency and Frequency Distributions.	**1** = Kikuyu **2** = Lari **3** = Githunguri
Project Age	Year of Project Commencement	Frequency Distributions.	**1** = 2011 **2** = 2010 **3** = 2009 **4** = 2008

Specific Objective 1:	**Degree of adherence to operational compliance by fish farmers. (Project Quality)**		
Indicator	**Attributes**	**Measurements**	**Scales**
Water Quality records	Promptness of Recording	Frequency Distributions.	**1** = I don't record **2** = At the end of the month **3** =At the end of the week **4**= Immediately.
Feeds and Feeding Records	Promptness of Recording	Frequency Distributions.	**1** = I don't record **2** = Once a month **3** = Once a week **4**= Daily
Sampling Records	Promptness of Recording	Frequency Distributions.	**1** = I don't record **2** = At the end of the production cycle **3** = Halfway through the production cycle **4** = Immediately the activities are done.
Sales Records	Promptness of Recording	Frequency Distributions.	**1** = I don't record **2** = Once Monthly **3** = Once Weekly **4** = Immediately after a sale.
Feeds and Feeding Records	Observed frequency of recording	Frequency Distributions.	**1** = Nonexistent **2** = Quarterly **3**= Monthly/Weekly **4** = Daily

Indicator	Attributes	Measurements	Scales
Sampling Records	Observed frequency of recording	Frequency Distributions.	**1** = Nonexistent **2** = Quarterly **3**= Monthly/Weekly **4** = Daily
Sales Records	Observed frequency of recording	Frequency Distributions.	**1** = Nonexistent **2** = Quarterly **3**= Monthly **4** = Daily
Record Keeping	Number project activities recorded (0%)	Frequency Distributions.	**1** = Three or more activities **2** = Two activities **3**= One activity **4** = No activity.
	Number project activities recorded (up to 60%)	Frequency Distributions.	**1** = No activity **2** = One activity **3**= Two activities **4** = Three or more activities.
Record Keeping	Number project activities recorded (61% to 90%)	Frequency Distributions.	**1** = No activity **2** = One activity **3**= Two activities **4** = Three or more activities.
	Number project activities recorded (91% to 100%)	Frequency Distributions.	**1** = No activity **2** = One activity **3**= Two activities **4** = Three or more activities.

Indicator	**Attributes**	**Measurements**	**Scales**
Pond Security	Observed Status of Perimeter	Frequency Distributions, Central Tendency and measures of Dispersion	**1** = None-existent **2** = Partially Secured **3** = Secured but needs reinforcement **4** = fully Secured
	Observed Status of fencing over Pond	Frequency Distributions, Central Tendency and measures of Dispersion	**1** = None-existent **2** = Partially Secured **3** = Secured but needs reinforcement **4** = fully Secured
Access to Technical Extension services.	Frequency per year	Frequency Distributions, Central Tendency and measures of Dispersion	**1** = 0 to 3 times **2** = 4 to 7 times **3** = 8 to 11 times **4** = 12 (and above) times
Marketing of fish	Availability of market	Frequency Distributions.	**1** = Not easily **2** = Fairly easily **3** = Easily **4** = Very easily
Specific Objective 2:	**Average Cost incurred in one production cycle (Cost Performance)**		
Indicator	**Attributes**	**Measurements**	**Scales**
Water Management	Drain and Re-fill the pond	Frequency Distributions.	**1** = Three or more times **2** = Twice **3** = Once **4** = No time

Indicator	Attributes	Measurements	Scales
Fees and Feeding	Cost of feeding	Frequency Distributions.	**1** = Above 6,000 **2** = 4,501 to 6,000 **3** = 3,000 to 4,500 **4** = Below 3,000
Marketing	Cost of Transport, Cooling etc	Frequency Distributions.	**1** = above 1,200/= **2** = 600/= to 1,200/= **3** = 1/= to 599/= **4** = 0/=
Cleaning the Pond	Total Number of Man days	Frequency Distributions and Central Tendency.	**1** = 10 and above **2** = 7 to 9 workers **3** = 4 to 6 workers **4** = 1 to 3 workers
Harvesting	Total Number of Man days	Frequency Distributions and Central Tendency.	**1** = 10 and above **2** = 7 to 9 workers **3** = 4 to 6 workers **4** = 1 to 3 workers
Specific Objective 3:	**Timeliness in achievement of project milestones. (Schedule Performance)**		
Indicator	**Attributes**	**Measurements**	**Scales**
Stocking Interval	Wait in Weeks	Frequency Distributions.	**1** = 5 to 6 weeks **2** = 3 to 4 weeks **3** = 1 to 2 weeks **4** = Below 1 week
Growth rate	Age at first harvest (Months)	Frequency Distributions, Central Tendency and Dispersion	**1** = 18 and above **2** = 14 to 17 months **3** = 10 to 13months **4** = Below 10 months

Indicator	Attributes	Measurements	Scales
Harvests per year	Frequency	Frequency Distributions,	**1** = 1 time **2** = 2 times **3** = 3 times **4** = Over 3 times
Specific Objective 4:	**Magnitude and Value of the production realized in a production cycle. (Project Output)**		
Indicator	**Attributes**	**Measurements**	**Scales**
Pond Production Capacity	Initial stock of Fingerlings	Frequency Distributions,	**1**= 100 to 349 **2** = 350 to 549 **3** = 550 to 749 **4** = 750 to 1000
Stock Sales per year	Proportion of the initial.	Frequency Distributions,	Up to 25% Up to 50% Up to 75% Up to 100% and over
Weight of Fish	Average unit weight at first harvest (kg)	Frequency Distributions	1= 1g to 250g 2 = 251g to 500g 3 = 501g to 750g 4 = 751 to 1000g
Price Tag	Price per Kg offered on the market	Frequency Distributions	**1** = 201/= to 300/= **2** = 301/= to 400/= **3** = 401/= to 500/= **4** = 501/= to 600/=

Indicator	Attributes	Measurements	Scales
Target Market	Type	Frequency Distributions	**1** = Homes **2** = Mama Samaki (Fryers) **3** = Fishmongers **4** = Hotels
	Distance to Market (Km)	Frequency Distributions and Central Tendency	**1** = 22 Km and above **2**= 15 to 21Km **3**= 8 to 14Km **4**= Up to 7 Km
Domestic Consumption	Percentage of initial Stock	Frequency Distributions	**1** = Over 100 pieces **2** = 71 to 100 pieces **3** = 31 to 70 pieces **4** = up to 30 pieces

Appendix IV: PROJECT IMPLEMENTATION SCHEDULE

Activity/Time	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Proposal Writing								
Proposal Presentation								
Defense								
Data Collection								
Data Analysis								
Report Writing								
Report Submission								

Appendix V: PROJECT BUDGET

Project Title: **Participatory Project Monitoring and Evaluation for Sustainable Pond Aquaculture in Kiambu County**

ACTIVITY	SUB-ACTIVITY/ITEM	UNIT	NO. OF UNITS	UNIT COST (KSH)	TOTAL COST (KSH)	REMARKS
Research Permit	Cost of Permit	Number	1	1,500	1,500	14 Days
Data Collection, Measurement, Entry and Analysis	Administer Interview	Data Sheet	102	200	20,400	15 Days (Concurrent)
	Data Measurement	Data Sheet	102	100	10,200	15 Days (Concurrent)
	Data Entry	Data Sheet	102	30	3,060	15 Days (Concurrent)
	Data Analysis	Data sheet	102	100	10,200	7 Days (Concurrent)
	Transport Expenses	Day	15	300	4,500	Commuter
Report Writing and Binding	Photocopying Expenses	Page	1,650	5	8,250	Drafts & Final Copies
	Typing Expenses	Page	150	10	1,500	Report Size
	Binding Expenses	Number	8	250	2,000	Final Document
				(KSH)	**61,610**	

Appendix VI: PROJECT PICTURES

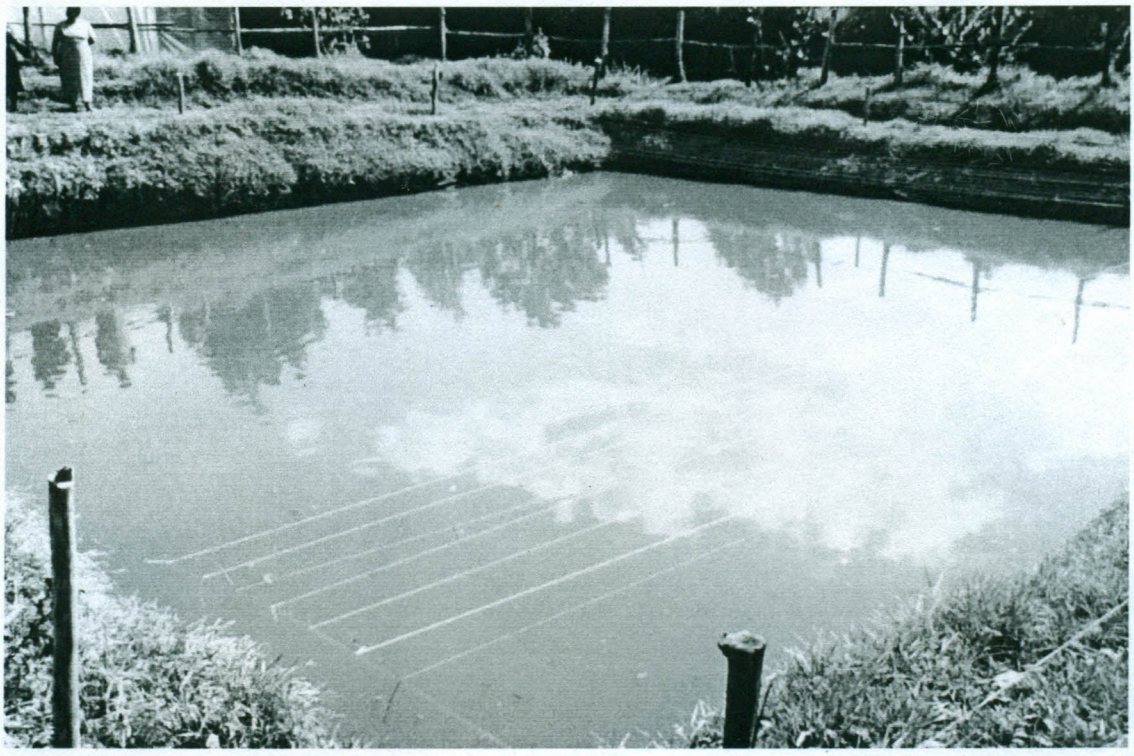
Earthen Pond (Without Overhead and Perimeter Security)

Lined Pond with Perimeter Fencing

Lined Pond with partial Overhead security and Perimeter Fencing

Unsecured Lined Pond

Damaged Earthen Ponds



Lined Pond with good quality stagnant water

Fingerlings

Fishing Net

The Fishing Activity

Appendix VII: MULTI-CRITERIA DECISION ANALYSIS – RESULTS (Tables and Graphs)

Outcome Variable	Factors	Sustainable Practice for the Project (Yes/No)
Stock of fish sold per pond per year relative to the Initial. (Cut off is up to three-quarter of initial stock)	Up to a quarter of the initial stock	NO
	Up to a half of the initial stock	NO
	Up to a three quarter of the initial stock	YES
	Up to the full of the initial stock	YES
Average Weight of Fish (Cut off is 250 to 499 grams)	< 250 grams	NO
	250 - 499 grams	YES
	500 – 749 grams	YES
	750+ grams	YES
Average Price of Fish per Kg (Cut off is 300 to 450 shillings).	< 300/=	NO
	300 – 450/=	YES
	451 – 500/=	YES
	500+/=	YES

Table 4.10: Sustainability variables

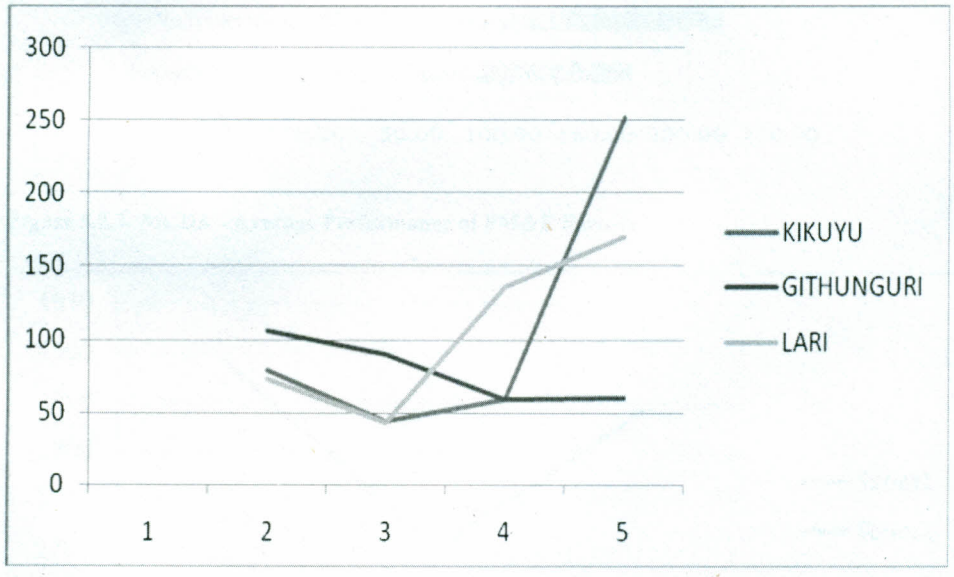


Figure 4.9.2: MCDA Record– Keeping and Pond Security

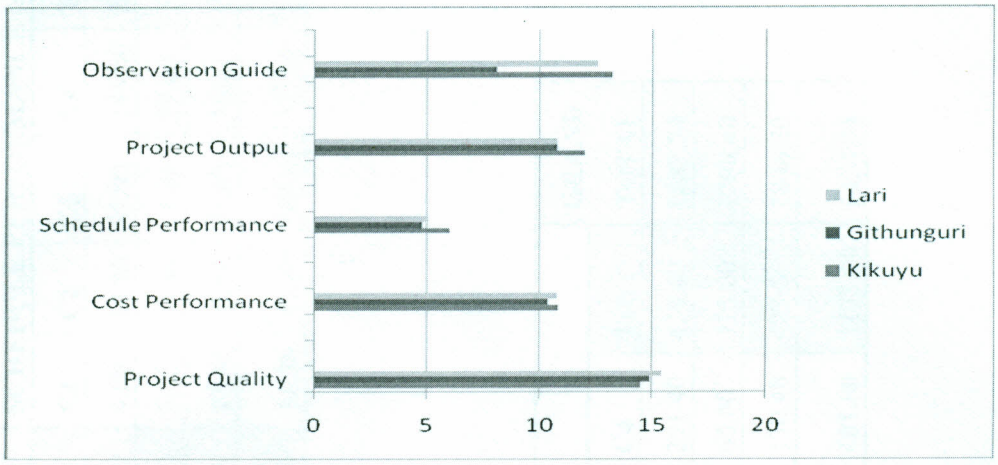


Figure 5.2.1: MCDA Performance PM&E by Project Location

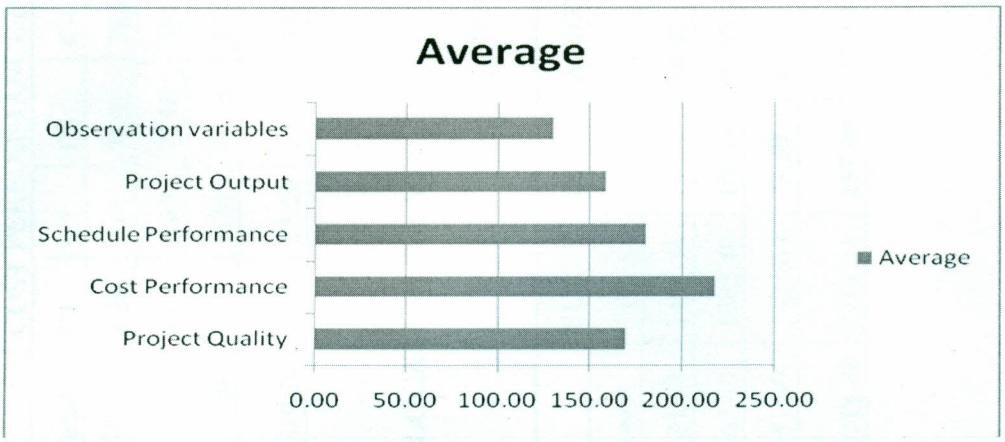


Figure 5.2.3: MCDA - Average Performance of PM&E Factors

Figure 5.2.2: MCDA Overall Performance by Project Location

MCDA PROJECT SUMMARY (BY PROJECT LOCATION)

PROJECT LOCATION	PROJECT QUALITY (A_1)					COST PERFORMANCE (A_2)					SCHEDULE PERFORMANCE (A_3)				
	C1	C2	C3	C4	Total	C1	C2	C3	C4	Total	C1	C2	C3	C4	Total
KIKUYU	50.41	37.21	163.85	237.67	489.14	3.00	9.60	70.20	283.20	367.80	4.80	10.80	45.00	144.00	204.60
GITHUNGURI	45.60	43.20	144.00	273.60	506.40	6.60	8.40	73.80	264.00	352.80	9.00	32.40	64.80	57.60	163.80
LARI	39.00	34.80	172.80	278.40	525.00	7.80	7.20	81.00	271.20	367.20	17.40	42.00	77.40	36.00	172.80
GRAND TOTAL	**135.01**	**115.21**	**480.65**	**789.67**	**1520.54**	**17.40**	**25.20**	**225.00**	**818.40**	**1087.80**	**31.20**	**85.20**	**187.20**	**237.60**	**541.20**

Table 4.3.5a: MCDA - Summary by Project Location

MCDA PROJECT SUMMARY (BY PROJECT LOCATION Cont'd)

PROJECT LOCATION	PROJECT OUTPUT (A_4)					SUB	OBSERVATION GUIDE					GRAND
	C1	C2	C3	C4	Total	TOTAL	C1	C2	C3	C4	Total	TOTAL
KIKUYU	27.00	84.00	36.00	244.80	391.80	**1453.34**	79.20	44.40	59.40	251.40	434.40	**1887.74**
GITHUNGURI	38.40	73.20	46.80	204.00	362.40	**1385.40**	105.60	90.00	59.40	60.00	315.00	**1700.40**
LARI	24.00	92.40	75.60	165.60	357.60	**1422.60**	73.20	43.20	136.80	170.40	423.60	**1846.20**
GRAND TOTAL	**89.40**	**249.60**	**158.40**	**614.40**	**1111.80**	**4261.34**	**258.00**	**177.60**	**255.60**	**481.80**	**1173.00**	**5434.34**

Table 4.3.5b: MCDA - Summary by Project Location (cont'd)

MCDA PROJECT SUMMARY (CENTRAL TENDENCY)

PROJECT LOCATION	PROJECT QUALITY			COST PERFORMANCE			SCHEDULE PERFORMANCE		
	MEAN	MODE	MEDIAN	MEAN	MODE	MEDIAN	MEAN	MODE	MEDIAN
KIKUYU	14.52	13.21	14.41	10.82	10.80	10.80	6.02	6.60	6.30
GITHUNGURI	14.89	14.40	14.40	10.38	11.40	10.80	4.82	4.80	4.80
LARI	15.44	15.60	15.60	10.80	11.40	10.80	5.08	3.60	4.20

Table 4.3.6a: MCDA – Mean, Mode and Median by Project Location

MCDA PROJECT SUMMARY (CENTRAL TENDENCY Cont'd)

PROJECT LOCATION	PROJECT OUTPUT			OBSERVATION GUIDE			SUB-TOTAL			GRAND TOTAL		
	MEAN	MODE	MEDIAN	MEAN	MODE	MEDIAN	MEAN	MODE	MEDIAN	MEAN	MODE	MEDIAN
KIKUYU	11.52	12.60	12.00	12.78	18.00	13.20	42.88	37.80	43.80	55.65	43.20	55.21
GITHUNGURI	10.66	10.80	10.80	9.26	7.80	8.10	40.75	37.80	40.50	50.01	48.00	49.50
LARI	10.52	12.00	10.80	12.46	12.6	12.6	41.84	42.00	41.40	54.30	55.20	54.00

Table 4.3.6b: MCDA – Mean, Mode and Median by Project Location (cont'd)

KIKUYU (MCDA – A_1 & A_2)

		PROJECT QUALITY (A1)					COST PERFORMANCE (A2)				
	CODE	C1	C2	C3	C4	Total	C1	C2	C3	C4	Total
1	KIK01	0.00	2.40	3.60	12.01	18.01	0.60	0.00	3.60	4.80	9.00
2	KIK02	0.60	1.20	5.40	9.60	16.81	0.00	0.00	1.80	9.60	11.40
3	KIK03	1.20	3.60	3.60	4.80	13.21	0.00	1.20	0.00	9.60	10.80
4	KIK04	0.00	2.40	7.20	7.20	16.81	0.00	0.00	3.60	7.20	10.80
5	KIK05	0.00	0.00	7.20	12.01	19.21	0.00	0.00	5.40	4.80	10.20
6	KIK06	0.60	0.00	0.00	19.21	19.81	0.60	1.20	0.00	7.20	9.00
7	KIK07	1.20	1.20	7.20	4.80	14.41	0.00	0.00	0.00	12.00	12.00
8	KIK08	1.80	1.20	5.40	4.80	13.21	0.00	0.00	3.60	7.20	10.80
9	KIK09	1.80	0.00	5.40	7.20	14.41	0.00	0.00	1.80	9.60	11.40
10	KIK10	1.80	1.20	5.40	4.80	13.21	0.00	0.00	3.60	7.20	10.80
11	KIK11	1.20	1.20	5.40	7.20	15.01	0.00	0.00	3.60	7.20	10.80
12	KIK12	1.20	1.20	7.20	4.80	14.41	0.00	0.00	3.60	7.20	10.80
13	KIK13	1.20	2.40	7.20	2.40	13.21	0.00	0.00	0.00	12.00	12.00
14	KIK14	0.60	1.20	3.60	12.01	17.41	0.00	2.40	3.60	2.40	8.40
15	KIK15	1.80	0.00	5.40	7.20	14.41	0.00	1.20	0.00	9.60	10.80
16	KIK16	3.00	0.00	1.80	7.20	12.01	0.00	0.00	0.00	12.00	12.00
17	KIK17	2.40	1.20	3.60	4.80	12.01	0.00	0.00	0.00	12.00	12.00
18	KIK18	1.80	1.20	5.40	4.80	13.21	0.00	0.00	1.80	9.60	12.00
19	KIK19	2.40	2.40	1.80	4.80	11.40	0.00	0.00	3.60	7.20	10.80
20	KIK20	2.40	0.00	9.00	0.00	11.40	0.00	1.20	1.80	7.20	10.20
21	KIK21	2.40	0.00	3,60	4.80	10.80	0.00	0.00	3.60	7.20	10.80
22	KIK22	2.40	0.00	3.60	7.20	13.20	0.00	0.00	1.80	9.60	11.40
23	KIK23	0.60	2.40	5.40	7.20	15.60	0.00	1.20	3.60	7.20	12.00
24	KIK24	0.60	1.20	5.40	9.60	16.80	0.00	0.00	3.60	7.20	10.80
25	KIK25	3.00	0.00	3.60	4.80	11.40	0.00	0.00	3.60	7.20	10.80
26	KIK26	1.20	1.20	5.40	7.20	15.00	0.60	1.20	0.00	7.20	9.00
27	KIK27	1.20	1.20	5.40	7.20	15.00	0.60	1.20	3.60	2.40	7.80
28	KIK28	2.40	0.00	3.60	7.20	13.20	0.00	0.00	0.00	12.00	12.00
29	KIK29	0.60	2.40	5.40	7.20	15.60	0.00	0.00	0.00	12.00	12.00
30	KIK30	2.40	0.00	5.40	4.80	12.60	0.00	0.00	0.00	12.00	12.00
31	KIK31	0.60	1.20	7.20	7.20	16.20	0.00	0.00	0.00	12.00	12.00
32	KIK32	2.40	1.20	1.80	7.20	12.60	0.60	0.00	0.00	9.60	10.20
33	KIK33	0.60	2.40	3.60	9.60	16.20	0.00	0.00	5.40	4.80	10.20
34	KIK34	3.00	0.00	3.60	4.80	11.40	0.00	0.00	3.60	7.20	10.80
KIK	**TOTAL**	**50.41**	**37.21**	**163.85**	**237.67**	**489.14**	**3.00**	**9.60**	**70.20**	**283.20**	**367.80**

KIKUYU (MCDA – A_3 & A_4)

	CODE	SCHEDULE PERFORMANCE (A_3)					PROJECT OUTPUT (A_4)					SUB-TOTAL
		C1	C2	C3	C4	Total	C1	C2	C3	C4	Total	
1	KIK01	1.20	0.00	0.00	2.40	3.60	1.20	3.60	0.00	4.80	9.60	**40.21**
2	KIK02	0.00	0.00	1.80	4.80	6.60	1.20	2.40	0.00	7.20	10.80	**45.61**
3	KIK03	0.60	1.20	1.80	0.00	3.60	0.60	2.40	1.80	7.20	12.00	**39.61**
4	KIK04	0.00	1.20	0.00	4.80	6.00	2.40	1.20	0.00	4.80	8.40	**42.01**
5	KIK05	0.00	0.00	1.80	4.80	6.60	0.00	3.60	1.80	7.20	12.60	**48.61**
6	KIK06	0.00	1.20	0.00	4.80	6.00	0.60	0.00	1.80	9.60	12.00	**46.81**
7	KIK07	0.00	0.00	3.60	2.40	6.00	0.60	1.20	3.60	7.20	12.60	**45.01**
8	KIK08	0.00	0.00	0.00	7.20	7.20	0.60	4.80	0.00	4.80	10.20	**41.41**
9	KIK09	0.00	0.00	0.00	7.20	7.20	0.00	2.40	1.80	9.60	13.80	**46.81**
10	KIK10	0.00	0.00	0.00	7.20	7.20	0.60	2.40	0.00	9.60	12.60	**43.81**
11	KIK11	0.00	0.00	0.00	7.20	7.20	0.00	3.60	0.00	9.60	13.20	**46.21**
12	KIK12	0.00	0.00	0.00	7.20	7.20	0.00	3.60	0.00	9.60	13.20	**45.61**
13	KIK13	0.00	0.00	1.80	4.80	6.60	2.40	2.40	1.80	0.00	6.60	**38.41**
14	KIK14	0.00	0.00	3.60	2.40	6.00	1.20	3.60	0.00	4.80	9.60	**41.41**
15	KIK15	0.00	0.00	1.80	4.80	6.60	0.00	2.40	3.60	7.20	13.20	**45.01**
16	KIK16	0.00	0.00	1.80	4.80	6.60	1.20	3.60	0.00	4.80	9.60	**40.21**
17	KIK17	0.00	0.00	1.80	4.80	6.60	0.60	2.40	1.80	7.20	12.00	**42.61**
18	KIK18	0.00	0.00	1.80	4.80	6.60	0.60	2.40	1.80	7.20	12.00	**43.81**
19	KIK19	0.00	1.20	0.00	4.80	6.00	1.20	0.00	1.80	9.60	12.60	**40.80**
20	KIK20	0.00	1.20	0.00	4.80	6.00	1.20	1.20	1.80	7.20	11.40	**39.00**
21	KIK21	0.00	0.00	5.40	0.00	5.40	1.20	2.40	0.00	7.20	10.80	**37.80**
22	KIK22	0.00	0.00	1.80	4.80	6.60	0.60	2.40	0.00	9.60	12.60	**43.80**
23	KIK23	0.00	0.00	1.80	4.80	6.60	0.00	2.40	1.80	9.60	13.80	**48.00**
24	KIK24	0.00	0.00	3.60	2.40	6.00	0.00	2.40	1.80	9.60	13.80	**47.40**
25	KIK25	0.60	2.40	0.00	0.00	3.00	0.00	3.60	1.80	7.20	12.60	**37.80**
26	KIK26	0.60	1.20	0.00	2.40	4.20	1.20	2.40	1.80	4.80	10.20	**38.40**
27	KIK27	0.00	0.00	0.00	7.20	7.20	1.80	2.40	0.00	4.80	9.00	**39.00**
28	KIK28	0.00	0.00	0.00	7.20	7.20	0.60	1.20	1.80	9.60	13.20	**45.60**
29	KIK29	0.60	0.00	1.80	2.40	4.80	0.60	3.60	0.00	7.20	11.40	**43.80**
30	KIK30	0.60	0.00	3.60	0.00	4.20	1.20	1.20	1.80	7.20	11.40	**40.20**
31	KIK31	0.00	0.00	3.60	2.40	6.00	0.60	3.60	0.00	7.20	11.40	**45.60**
32	KIK32	0.60	0.00	0.00	4.80	5.40	1.20	2.40	1.80	4.80	10.20	**38.40**
33	KIK33	0.00	0.00	1.80	4.80	6.60	1.20	2.40	0.00	7.20	10.80	**43.80**
34	KIK34	0.00	1.20	0.00	4.80	6.00	0.60	2.40	0.00	9.60	12.60	**40.80**
KIK	**TOTAL**	**4.80**	**10.80**	**45.00**	**144.00**	**204.60**	**27.00**	**84.00**	**36.00**	**244.80**	**391.80**	**1453.34**

KIKUYU (MCDA - OBS)

	CODE	OBSERVATION GUIDE					GRAND TOTAL
		C1	C2	C3	C4	Total	
1	KIK01	1.20	2.40	7.20	2.40	13.20	**53.41**
2	KIK02	0.60	2.40	3.60	9.60	16.20	**61.81**
3	KIK03	3.00	2.40	1.80	1.80	9.00	**48.61**
4	KIK04	1.20	0.00	1.80	14.40	17.40	**59.41**
5	KIK05	0.00	0.00	9.00	9.60	18.60	**67.21**
6	KIK06	0.00	0.00	0.00	21.60	21.60	**68.41**
7	KIK07	0.60	4.80	1.80	7.20	14.40	**59.41**
8	KIK08	4.80	1.20	0.00	0.00	6.00	**47.41**
9	KIK09	1.20	0.00	3.60	12.00	16.80	**63.61**
10	KIK10	0.60	1.20	1.80	14.40	18.00	**61.81**
11	KIK11	0.60	1.20	1.80	14.40	18.00	**64.21**
12	KIK12	0.60	1.20	1.80	14.40	18.00	**63.61**
13	KIK13	4.20	0.00	3.60	0.00	7.80	**46.21**
14	KIK14	0.00	2.40	0.00	16.80	19.20	**60.61**
15	KIK15	3.00	2.40	1.80	4.80	12.00	**57.01**
16	KIK16	1.20	4.80	0.00	7.20	13.20	**53.41**
17	KIK17	5.40	0.00	0.00	0.00	5.40	**48.01**
18	KIK18	5.40	0.00	0.00	0.00	5.40	**49.21**
19	KIK19	2.40	3.60	0.00	4.80	10.80	**51.60**
20	KIK20	2.40	1.20	1.80	7.20	12.60	**51.60**
21	KIK21	5.40	0.00	0.00	0.00	5.40	**43.20**
22	KIK22	1.20	1.20	3.60	9.60	15.60	**59.40**
23	KIK23	0.60	0.00	0.00	19.20	19.80	**67.80**
24	KIK24	0.60	0.00	0.00	19.20	19.80	**67.20**
25	KIK25	5.40	0.00	0.00	0.00	5.40	**43.20**
26	KIK26	3.00	2.40	1.80	2.40	9.60	**48.00**
27	KIK27	2.40	0.00	1.80	9.60	13.80	**52.80**
28	KIK28	4.80	1.20	0.00	0.00	6.00	**51.60**
29	KIK29	4.20	0.00	3.60	0.00	7.80	**51.60**
30	KIK30	4.20	2.40	0.00	0.00	6.60	**46.80**
31	KIK31	1.20	2.40	1.80	9.60	15.00	**60.60**
32	KIK32	4.20	0.00	0.00	4.80	9.00	**47.40**
33	KIK33	0.00	2.40	3.60	12.00	18.00	**61.80**
34	KIK34	3.60	1.20	1.80	2.40	9.00	**49.80**
KIK	**TOTAL**	**79.20**	**44.40**	**59.40**	**251.40**	**434.40**	**1887.74**

GITHUNGURI (MCDA – A_1 & A_2)

	CODE	PROJECT QUALITY (A_1)					COST PERFORMANCE (A_2)				
		C1	C2	C3	C4	Total	C1	C2	C3	C4	Total
35	GIT01	1.80	0.00	1.80	12.00	15.60	1.20	0.00	1.80	4.80	7.80
36	GIT02	0.60	0.00	5.40	12.00	18.00	0.00	4.80	0.00	2.40	7.20
37	GIT03	0.60	0.00	7.20	9.60	17.40	0.00	0.00	3.60	7.20	10.80
38	GIT04	0.00	1.20	7.20	9.60	18.00	0.60	1.20	1.80	4.80	8.40
39	GIT05	1.20	2.40	3.60	7.20	14.40	0.60	0.00	1.80	7.20	9.60
40	GIT06	2.40	2.40	1.80	4.80	11.40	0.00	0.00	1.80	9.60	11.40
41	GIT07	1.80	1.20	1.80	9.60	14.40	0.00	0.00	1.80	9.60	11.40
42	GIT08	0.60	1.20	1.80	14.40	18.00	0.00	0.00	3.60	7.20	10.80
43	GIT09	1.80	0.00	5.40	7.20	14.40	0.60	0.00	5.40	2.40	8.40
44	GIT10	1.20	1.20	7.20	4.80	14.40	0.00	0.00	3.60	7.20	10.80
45	GIT11	0.60	1.20	5.40	9.60	16.80	0.00	0.00	3.60	7.20	10.80
46	GIT12	0.60	2.40	5.40	7.20	15.60	0.60	0.00	1.80	7.20	9.60
47	GIT13	1.80	0.00	5.40	7.20	14.40	0.60	0.00	1.80	7.20	9.60
48	GIT14	0.60	2.40	1.80	12.00	16.80	0.60	0.00	3.60	4.80	9.00
49	GIT15	3.00	1.20	1.80	4.80	10.80	0.60	0.00	1.80	7.20	9.60
50	GIT16	0.00	2.40	5.40	9.60	17.40	0.00	0.00	1.80	7.20	9.00
51	GIT17	0.00	2.40	3.60	12.00	18.00	0.60	0.00	1.80	7.20	9.60
52	GIT18	0.00	3.60	1.80	12.00	17.40	0.00	0.00	1.80	9.60	11.40
53	GIT19	0.00	0.00	9.00	9.60	18.60	0.00	0.00	1.80	9.60	11.40
54	GIT20	0.60	1.20	5.40	9.60	16.80	0.00	0.00	1.80	9.60	11.40
55	GIT21	0.60	0.00	7.20	9.60	17.40	0.00	0.00	1.80	9.60	11.40
56	GIT22	1.20	3.60	0.00	9.60	14.40	0.00	1.20	1.80	7.20	10.20
57	GIT23	0.00	0.00	7.20	12.00	19.20	0.00	0.00	1.80	9.60	11.40
58	GIT24	1.80	0.00	3.60	9.60	15.00	0.00	1.20	0.00	9.60	10.80
59	GIT25	2.40	1.20	5.40	2.40	11.40	0.00	0.00	1.80	9.60	11.40
60	GIT26	2.40	0.00	5.40	4.80	12.60	0.00	0.00	1.80	9.60	11.40
61	GIT27	2.40	0.00	3.60	7.20	13.20	0.00	0.00	3.60	7.20	10.80
62	GIT28	1.80	1.20	5.40	4.80	13.20	0.00	0.00	1.80	9.60	11.40
63	GIT29	2.40	1.20	1.80	7.20	12.60	0.00	0.00	1.80	9.60	11.40
64	GIT30	3.00	2.40	1.80	2.40	9.60	0.00	0.00	1.80	9.60	11.40
65	GIT31	2.40	3.60	1.80	2.40	10.20	0.00	0.00	3.60	7.20	10.80
66	GIT32	1.80	1.20	5.40	4.80	13.20	0.00	0.00	1.80	9.60	11.40
67	GIT33	1.80	0.00	5.40	7.20	14.40	0.60	0.00	1.80	7.20	9.60
68	GIT34	2.40	2.40	1.80	4.80	11.40	0.00	0.00	1.80	9.60	11.40
GIT	**TOTAL**	**45.60**	**43.20**	**144.00**	**273.60**	**506.40**	**6.60**	**8.40**	**73.80**	**264.00**	**352.80**

GITHUNGURI (MCDA – A_3 & A_4)

	CODE	SCHEDULE PERFORMANCE (A_3)					PROJECT OUTPUT (A_4)					SUB
		C1	C2	C3	C4	Total	C1	C2	C3	C4	Total	TOTAL
35	GIT01	0.60	0.00	0.00	4.80	5.40	1.20	3.60	1.80	2.40	9.00	**37.80**
36	GIT02	0.00	0.00	1.80	4.80	6.60	1.80	1.20	1.80	4.80	9.60	**41.40**
37	GIT03	0.00	1.20	1.80	2.40	5.40	1.20	2.40	0.00	7.20	10.80	**44.40**
38	GIT04	0.60	0.00	1.80	2.40	4.80	1.20	2.40	0.00	7.20	10.80	**42.00**
39	GIT05	0.00	2.40	1.80	0.00	4.20	0.60	2.40	3.60	4.80	11.40	**39.60**
40	GIT06	0.00	2.40	0.00	2.40	4.80	1.20	2.40	0.00	7.20	10.80	**38.40**
41	GIT07	0.60	0.00	1.80	2.40	4.80	1.20	1.20	1.80	7.20	11.40	**42.00**
42	GIT08	0.00	0.00	3.60	2.40	6.00	0.60	0.00	1.80	12.00	14.40	**49.20**
43	GIT09	0.00	3.60	0.00	0.00	3.60	1.80	1.20	0.00	7.20	10.20	**36.60**
44	GIT10	0.00	1.20	3.60	0.00	4.80	-0.60	1.20	3.60	7.20	11.40	**41.40**
45	GIT11	0.00	1.20	1.80	2.40	5.40	2.40	0.00	1.80	4.80	9.00	**42.00**
46	GIT12	0.60	1.20	0.00	2.40	4.20	0.60	3.60	1.80	4.80	10.80	**40.20**
47	GIT13	0.00	1.20	3.60	0.00	4.80	0.60	3.60	1.80	4.80	10.80	**39.60**
48	GIT14	0.60	0.00	1.80	2.40	4.80	1.20	3.60	0.00	4.80	9.60	**40.20**
49	GIT15	0.00	0.00	3.60	2.40	6.00	1.20	2.40	1.80	4.80	10.20	**36.60**
50	GIT16	0.60	1.20	1.80	0.00	3.60	1.20	2.40	1.80	4.80	10.20	**40.20**
51	GIT17	0.60	1.20	1.80	0.00	3.60	2.40	1.20	0.00	4.80	8.40	**39.60**
52	GIT18	0.60	1.20	1.80	0.00	3.60	1.20	1.20	3.60	4.80	10.80	**43.20**
53	GIT19	0.60	1.20	1.80	0.00	3.60	1.20	2.40	1.80	4.80	10.20	**43.80**
54	GIT20	0.60	1.20	1.80	0.00	3.60	1.20	2.40	0.00	7.20	10.80	**42.60**
55	GIT21	0.60	1.20	1.80	0.00	3.60	1.80	1.20	0.00	7.20	10.20	**42.60**
56	GIT22	0.00	0.00	3.60	2.40	6.00	1.80	1.20	0.00	7.20	10.20	**40.80**
57	GIT23	0.00	0.00	1.80	4.80	6.60	0.60	3.60	1.80	4.80	10.80	**48.00**
58	GIT24	0.00	0.00	3.60	2.40	6.00	1.20	2.40	3.60	2.40	9.60	**41.40**
59	GIT25	0.00	2.40	0.00	2.40	4.80	0.60	4.80	0.00	4.80	10.20	**37.80**
60	GIT26	1.20	0.00	1.80	0.00	3.00	0.60	1.20	1.80	9.60	13.20	**40.20**
61	GIT27	0.00	1.20	1.80	2.40	5.40	0.60	2.40	3.60	4.80	11.40	**40.80**
62	GIT28	0.00	2.40	0.00	2.40	4.80	2.40	0.00	0.00	7.20	9.60	**39.00**
63	GIT29	0.00	1.20	0.00	4.80	6.00	0.60	2.40	0.00	9.60	12.60	**42.60**
64	GIT30	0.60	1.20	0.00	2.40	4.20	0.60	2.40	1.80	7.20	12.00	**37.20**
65	GIT31	0.60	1.20	1.80	0.00	3.60	1.20	2.40	0.00	7.20	10.80	**35.40**
66	GIT32	0.00	0.00	5.40	0.00	5.40	1.20	2.40	3.60	2.40	9.60	**39.60**
67	GIT33	0.00	1.20	1.80	2.40	5.40	0.60	2.40	1.80	7.20	12.00	**41.40**
68	GIT34	0.00	0.00	5.40	0.00	5.40	1.20	3.60	0.00	4.80	9.60	**37.80**
GIT	**TOTAL**	**9.00**	**32.40**	**64.80**	**57.60**	**163.80**	**38.40**	**73.20**	**46.80**	**204.00**	**362.40**	**1385.40**

GITHUNGURI (MCDA - OBS)

	CODE	OBSERVATION GUIDE					GRAND
		C1	C2	C3	C4	Total	TOTAL
35	GIT01	1.80	0.00	9.00	2.40	13.20	**51.00**
36	GIT02	2.40	0.00	5.40	4.80	12.60	**54.00**
37	GIT03	1.20	0.00	1.80	14.40	17.40	**61.80**
38	GIT04	1.80	6.00	0.00	2.40	10.20	**52.20**
39	GIT05	4.80	1.20	0.00	0.00	6.00	**45.60**
40	GIT06	5.40	0.00	0.00	0.00	5.40	**43.80**
41	GIT07	2.40	6.00	0.00	0.00	8.40	**50.40**
42	GIT08	4.20	0.00	1.80	2.40	8.40	**57.60**
43	GIT09	0.60	1.20	12.60	0.00	14.40	**51.00**
44	GIT10	4.80	1.20	0.00	0.00	6.00	**47.40**
45	GIT11	1.20	8.40	0.00	0.00	9.60	**51.60**
46	GIT12	3.00	4.80	0.00	0.00	7.80	**48.00**
47	GIT13	3.00	4.80	0.00	0.00	7.80	**47.40**
48	GIT14	3.00	4.80	0.00	0.00	7.80	**48.00**
49	GIT15	3.00	4.80	0.00	0.00	7.80	**44.40**
50	GIT16	2.40	3.60	3.60	0.00	9.60	**49.80**
51	GIT17	4.80	1.20	0.00	0.00	6.00	**45.60**
52	GIT18	3.00	2.40	0.00	4.80	10.20	**53.40**
53	GIT19	1.80	3.60	5.40	0.00	10.80	**54.60**
54	GIT20	1.20	3.60	7.20	0.00	12.00	**54.60**
55	GIT21	1.20	3.60	7.20	0.00	12.00	**54.60**
56	GIT22	2.40	6.00	0.00	0.00	8.40	**49.20**
57	GIT23	3.00	4.80	0.00	0.00	7.80	**55.80**
58	GIT24	4.20	2.40	0.00	0.00	6.60	**48.00**
59	GIT25	4.20	2.40	0.00	0.00	6.60	**44.40**
60	GIT26	4.80	1.20	0.00	0.00	6.00	**46.20**
61	GIT27	2.40	3.60	1.80	9.60	17.40	**58.20**
62	GIT28	4.80	1.20	1.80	9.60	17.40	**56.40**
63	GIT29	2.40	0.00	0.00	0.00	2.40	**45.00**
64	GIT30	4.20	2.40	0.00	0.00	6.60	**43.80**
65	GIT31	4.20	2.40	0.00	0.00	6.60	**42.00**
66	GIT32	4.20	2.40	0.00	0.00	6.60	**46.20**
67	GIT33	2.40	0.00	1.80	9.60	13.80	**55.20**
68	GIT34	5.40	0.00	0.00	0.00	5.40	**43.20**
GIT	**TOTAL**	**105.60**	**90.00**	**59.40**	**60.00**	**315.00**	**1700.40**

LARI (MCDA – A_1 & A_2)

	CODE	PROJECT QUALITY (A_1)					COST PERFORMANCE (A_2)				
		C1	C2	C3	C4	Total	C1	C2	C3	C4	Total
69	LAR01	1.20	0.00	1.80	14.40	17.40	0.60	0.00	1.80	7.20	9.60
70	LAR02	1.20	0.00	7.20	7.20	15.60	0.00	0.00	1.80	9.60	11.40
71	LAR03	0.60	1.20	9.00	4.80	15.60	0.00	0.00	5.40	4.80	10.20
72	LAR04	1.80	0.00	7.20	4.80	13.80	0.00	1.20	1.80	7.20	10.20
73	LAR05	1.80	1.20	3.60	7.20	13.80	0.00	0.00	1.80	2.40	4.20
74	LAR06	1.20	1.20	5.40	7.20	15.00	0.60	0.00	3.60	4.80	9.00
75	LAR07	1.20	4.80	1.80	4.80	12.60	0.00	0.00	3.60	7.20	10.80
76	LAR08	1.20	1.20	3.60	9.60	15.60	0.00	0.00	3.60	7.20	10.80
77	LAR09	1.20	2.40	3.60	7.20	14.40	0.00	0.00	1.80	9.60	11.40
78	LAR10	1.20	1.20	5.40	7.20	15.00	0.00	0.00	0.00	12.00	12.00
79	LAR11	1.20	2.40	1.80	9.60	15.00	0.00	0.00	0.00	12.00	12.00
80	LAR12	1.80	1.20	3.60	7.20	13.80	0.00	0.00	5.40	4.80	10.20
81	LAR13	0.00	2.40	7.20	7.20	16.80	0.00	0.00	5.40	4.80	10.20
82	LAR14	0.60	1.20	9.00	4.80	15.60	0.00	0.00	3.60	7.20	10.80
83	LAR15	0.60	1.20	9.00	4.80	15.60	0.00	0.00	3.60	7.20	10.80
84	LAR16	1.80	1.20	3.60	7.20	13.80	0.00	0.00	5.40	4.80	10.20
85	LAR17	1.20	1.20	3.60	9.60	15.60	6.00	0.00	3.60	7.20	16.80
86	LAR18	1.20	0.00	3.60	12.00	16.80	0.00	0.00	3.60	7.20	10.80
87	LAR19	1.20	0.00	5.40	9.60	16.20	0.00	0.00	1.80	9.60	11.40
88	LAR20	1.20	0.00	7.20	7.20	15.60	0.00	1.20	1.80	7.20	10.20
89	LAR21	1.20	0.00	3.60	12.00	16.80	0.00	2.40	1.80	4.80	9.00
90	LAR22	1.20	0.00	5.40	9.60	16.20	0.00	0.00	1.80	9.60	11.40
91	LAR23	1.20	1.20	3.60	9.60	15.60	0.00	0.00	1.80	9.60	11.40
92	LAR24	1.20	0.00	7.20	7.20	15.60	0.00	0.00	1.80	9.60	11.40
93	LAR25	1.20	0.00	5.40	9.60	16.20	0.00	0.00	3.60	7.20	10.80
94	LAR26	1.20	0.00	5.40	9.60	16.20	0.00	0.00	1.80	9.60	11.40
95	LAR27	1.20	1.20	5.40	7.20	15.00	0.00	0.00	1.80	9.60	11.40
96	LAR28	1.20	0.00	5.40	9.60	16.20	0.00	1.20	0.00	9.60	10.80
97	LAR29	1.20	0.00	7.20	7.20	15.60	0.00	0.00	0.00	12.00	12.00
98	LAR30	1.80	1.20	0.00	12.00	15.00	0.00	1.20	1.80	7.20	10.20
99	LAR31	0.60	1.20	5.40	9.60	16.80	0.00	0.00	1.80	9.60	11.40
100	LAR32	0.00	2.40	7.20	7.20	16.80	0.60	0.00	1.80	7.20	9.60
101	LAR33	1.20	2.40	3.60	7.20	14.40	0.00	0.00	0.00	12.00	12.00
102	LAR34	1.20	1.20	5.40	7.20	15.00	0.00	0.00	1.80	9.60	11.40
LAR	**TOTAL**	**39.00**	**34.80**	**172.80**	**278.40**	**525.00**	**7.80**	**7.20**	**81.00**	**271.20**	**367.20**

LARI (MCDA – A_3 & A_4)

	CODE	SCHEDULE PERFORMANCE (A3)					PROJECT OUTPUT (A4)					SUB
		C1	C2	C3	C4	Total	C1	C2	C3	C4	Total	TOTAL
69	LAR01	0.60	0.00	3.60	0.00	4.20	1.20	1.20	3.60	4.80	10.80	**42.00**
70	LAR02	0.60	1.20	0.00	2.40	4.20	1.20	1.20	1.80	7.20	11.40	**42.60**
71	LAR03	0.60	1.20	1.80	0.00	3.60	0.60	4.80	0.00	4.80	10.20	**39.60**
72	LAR04	0.60	0.00	0.00	4.80	5.40	1.20	1.20	0.00	4.80	7.20	**36.60**
73	LAR05	0.60	1.20	0.00	2.40	4.20	1.20	2.40	5.40	0.00	9.00	**31.20**
74	LAR06	0.60	1.20	1.80	0.00	3.60	1.80	2.40	0.00	4.80	9.00	**36.60**
75	LAR07	0.00	0.00	1.80	4.80	6.60	1.20	1.20	3.60	4.80	10.80	**40.80**
76	LAR08	0.00	0.00	3.60	2.40	6.00	0.60	2.40	1.80	7.20	12.00	**44.40**
77	LAR09	0.60	1.20	1.80	0.00	3.60	1.20	1.20	3.60	4.80	10.80	**40.20**
78	LAR10	0.60	0.00	3.60	0.00	4.20	0.60	4.80	0.00	4.80	10.20	**41.40**
79	LAR11	1.80	0.00	0.00	0.00	1.80	0.00	3.60	3.60	4.80	12.00	**40.80**
80	LAR12	0.60	1.20	1.80	0.00	3.60	0.60	4.80	1.80	2.40	9.60	**37.20**
81	LAR13	0.60	1.20	0.00	2.40	4.20	0.60	3.60	1.80	4.80	10.80	**42.00**
82	LAR14	0.00	0.00	5.40	0.00	5.40	0.60	2.40	1.80	7.20	12.00	**43.80**
83	LAR15	0.00	0.00	0.00	7.20	7.20	0.60	2.40	1.80	7.20	12.00	**45.60**
84	LAR16	0.60	1.20	1.80	0.00	3.60	0.60	3.60	0.00	7.20	11.40	**39.00**
85	LAR17	0.60	0.00	1.80	2.40	4.80	0.00	4.80	0.00	7.20	12.00	**49.20**
86	LAR18	0.60	2.40	0.00	0.00	3.00	0.60	2.40	1.80	7.20	12.00	**42.60**
87	LAR19	0.60	1.20	1.80	0.00	3.60	0.60	3.60	1.80	4.80	10.80	**42.00**
88	LAR20	1.20	1.20	18.00	0.00	20.40	0.60	4.80	0.00	4.80	10.20	**56.40**
89	LAR21	0.60	1.20	1.80	0.00	3.60	0.00	1.20	5.40	7.20	13.80	**43.20**
90	LAR22	1.20	1.20	0.00	0.00	2.40	0.60	3.60	1.80	4.80	10.80	**40.80**
91	LAR23	0.60	2.40	0.00	0.00	3.00	1.20	2.40	1.80	4.80	10.20	**40.20**
92	LAR24	0.60	2.40	18.00	0.00	21.00	0.60	0.00	9.00	2.40	12.00	**60.00**
93	LAR25	0.60	2.40	0.00	0.00	3.00	0.60	2.40	3.60	4.80	11.40	**41.40**
94	LAR26	0.60	2.40	0.00	0.00	3.00	0.60	3.60	1.80	4.80	10.80	**41.40**
95	LAR27	0.60	2.40	0.00	0.00	3.00	0.60	3.60	1.80	4.80	10.80	**40.20**
96	LAR28	0.60	2.40	0.00	0.00	3.00	0.60	1.20	5.40	4.80	12.00	**42.00**
97	LAR29	0.60	2.40	0.00	0.00	3.00	0.60	1.20	1.80	2.40	6.00	**36.60**
98	LAR30	0.00	1.20	1.80	2.40	5.40	0.60	1.20	1.80	4.80	8.40	**39.00**
99	LAR31	0.00	1.20	1.80	2.40	5.40	0.60	1.20	1.80	2.40	6.00	**39.60**
100	LAR32	0.00	1.20	1.80	2.40	5.40	0.60	4.80	0.00	4.80	10.20	**42.00**
101	LAR33	0.00	2.40	1.80	0.00	4.20	0.60	3.60	3.60	2.40	10.20	**40.80**
102	LAR34	0.00	2.40	1.80	0.00	4.20	0.60	3.60	1.80	4.80	10.80	**41.40**
LAR	**TOTAL**	**17.40**	**42.00**	**77.40**	**36.00**	**172.80**	**24.00**	**92.40**	**75.60**	**165.60**	**357.60**	**1422.60**

LARI (MCDA - OBS)

	CODE	OBSERVATION GUIDE					GRAND TOTAL
		C1	C2	C3	C4	Total	
69	LAR01	1.80	0.00	3.60	9.60	15.00	**57.00**
70	LAR02	1.80	1.20	1.80	9.60	14.40	**57.00**
71	LAR03	2.40	0.00	5.40	4.80	12.60	**52.20**
72	LAR04	2.40	3.60	1.80	2.40	10.20	**46.80**
73	LAR05	1.80	0.00	5.40	7.20	14.40	**45.60**
74	LAR06	2.40	0.00	5.40	4.80	12.60	**49.20**
75	LAR07	5.40	0.00	0.00	0.00	5.40	**46.20**
76	LAR08	1.80	0.00	5.40	7.20	14.40	**58.80**
77	LAR09	2.40	0.00	5.40	4.80	12.60	**52.80**
78	LAR10	1.20	3.60	1.80	7.20	13.80	**55.20**
79	LAR11	3.00	4.80	0.00	0.00	7.80	**48.60**
80	LAR12	1.80	2.40	1.80	7.20	13.20	**50.40**
81	LAR13	1.20	0.00	5.40	9.60	16.20	**58.20**
82	LAR14	1.20	8.40	0.00	0.00	9.60	**53.40**
83	LAR15	1.20	8.40	0.00	0.00	9.60	**55.20**
84	LAR16	0.60	0.00	5.40	9.60	15.60	**54.60**
85	LAR17	2.40	0.00	5.40	4.80	12.60	**61.80**
86	LAR18	2.40	0.00	5.40	4.80	12.60	**55.20**
87	LAR19	1.80	1.20	5.40	4.80	13.20	**55.20**
88	LAR20	2.40	0.00	5.40	4.80	12.60	**69.00**
89	LAR21	2.40	0.00	5.40	4.80	12.60	**55.80**
90	LAR22	2.40	0.00	5.40	4.80	12.60	**53.40**
91	LAR23	2.40	0.00	5.40	4.80	12.60	**52.80**
92	LAR24	2.40	0.00	5.40	4.80	12.60	**72.60**
93	LAR25	2.40	0.00	5.40	4.80	12.60	**54.00**
94	LAR26	2.40	0.00	5.40	4.80	12.60	**54.00**
95	LAR27	2.40	0.00	5.40	4.80	12.60	**52.80**
96	LAR28	2.40	0.00	5.40	4.80	12.60	**54.60**
97	LAR29	2.40	0.00	5.40	4.80	12.60	**49.20**
98	LAR30	1.20	0.00	5.40	9.60	16.20	**55.20**
99	LAR31	4.20	1.20	1.80	0.00	7.20	**46.80**
100	LAR32	1.20	8.40	0.00	0.00	9.60	**51.60**
101	LAR33	1.20	0.00	5.40	9.60	16.20	**57.00**
102	LAR34	2.40	0.00	5.40	4.80	12.60	**54.00**
LAR	**TOTAL**	**73.20**	**43.20**	**136.80**	**170.40**	**423.60**	**1846.20**

Appendix VIII: PEARSON'S MOMENT CORRELATION COEFFICIENT RESULTS

Correlations: Table 4.4.1 PMCC – Cost Performance and Project Sustainability

		Stock sold per year (relative to the initial)	Average weight of fish at harvest	Average price offered per kg	Cost of feeding up to first harvest	Marketing Cost	Number of man days for harvesting
Stock sold per year (relative to the initial)	Pearson Correlation	1.000	.274**	.113	.032	-.233*	.255**
	Sig. (2-tailed)		.005	.259	.750	.018	.010
	N	102.000	102	102	102	102	101
Average weight of fish at harvest	Pearson Correlation	.274**	1.000	.225*	-.030	-.236*	.193
	Sig. (2-tailed)	.005		.023	.768	.017	.053
	N	102	102.000	102	102	102	101
Average price offered per kg	Pearson Correlation	.113	.225*	1.000	.028	-.214*	-.014
	Sig. (2-tailed)	.259	.023		.777	.031	.887
	N	102	102	102.000	102	102	101

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations Table 4.4.2 PMCC – Schedule Performance and Project Sustainability

		Stock sold per year (relative to the initial)	Average weight of fish at harvest	Average price offered per kg	Length of wait after order for fingerlings	Age of fish in months at first harvest	Number of harvests per year including first harvest
Stock sold per year (relative to the initial)	Pearson Correlation	1.000	.274**	.113	.077	-.201*	-.087
	Sig. (2-tailed)		.005	.259	.439	.042	.384
	N	102.000	102	102	102	102	102
Average weight of fish at harvest	Pearson Correlation	.274**	1.000	.225*	-.059	.000	-.012
	Sig. (2-tailed)	.005		.023	.554	1.000	.908
	N	102	102.000	102	102	102	102
Average price offered per kg	Pearson Correlation	.113	.225*	1.000	-.157	-.105	-.156
	Sig. (2-tailed)	.259	.023		.116	.292	.116
	N	102	102	102.000	102	102	102

*Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations: Table 4.4.3 PMCC – Project Output and Project Sustainability

		Initial stock of fingerlings	Estimate (no. of pieces) of fish eaten on the farm per year	Number of harvests per year including first harvest	Stock sold per year (relative to the initial)	Average weight of fish at harvest	Average price offered per kg
Stock sold per year (relative to the initial)	Pearson Correlation	-.144	-.001	-.087	1.000	.274**	.113
	Sig. (2-tailed)	.149	.990	.384		.005	.259
	N	102	102	102	102.000	102	102
Average weight of fish at harvest	Pearson Correlation	.012	.110	-.012	.274**	1.000	.225*
	Sig. (2-tailed)	.902	.270	.908	.005		.023
	N	102	102	102	102	102.000	102
Average price offered per kg	Pearson Correlation	-.008	-.013	-.156	.113	.225*	1.000
	Sig. (2-tailed)	.937	.893	.116	.259	.023	
	N	102	102	102	102	102	102.000

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix IX: CHI-SQUARE TEST RESULTS (Tables)

Table 4.5.2: Chi-Square – Project Quality by Location

Baseline Factors	Project Location (District)						Chi-Square Statistic	p value
	Kikuyu		Githunguri		Lari			
	Freq.	%	Freq.	%	Freq.	%		
Top up to maintain Water Quantity and Quality								
Continuous flow through pond	22	64.7	17	50.0	6	17.6		
When the level goes down	0	0.0	0	0.0	5	14.7	27.5	***<0.001***
Quarterly	1	2.9	2	5.9	8	23.5		
Never	11	32.4	15	44.1	15	44.1		
Ease of finding feed for the fish								
Not Easily	5	14.7	10	29.4	2	5.9		
Fairly Easily	8	23.5	0	0.0	2	5.9	18	***0.006***
Easily	19	55.9	22	64.7	28	82.4		
Very Easily	2	5.9	2	5.9	2	5.9		
Frequency of sampling per year								
Never	14	41.2	18	52.9	28	82.4		
Once at any time	4	11.8	8	23.5	0	0.0	22.7	***0.001***
Every 6 months	4	11.8	5	14.7	3	8.8		
Quarterly	12	35.3	3	8.8	3	8.8		
Reason for sampling								
I don't sample	11	32.4	17	50.0	27	79.4		
I don't know	0	0.0	1	2.9	0	0.0	28.5	***<0.001***
To check the size of fish	22	64.7	9	26.5	5	14.7		
To estimate the pond population	1	2.9	7	20.6	2	5.9		
Ease of finding market for fish								
Not Easily	14	41.2	12	35.3	1	2.9		
Fairly Easily	5	14.7	1	2.9	3	8.8	21.9	***0.001***
Easily	11	32.4	20	58.8	27	79.4		
Very Easily	4	11.8	1	2.9	3	8.8		
Fisheries Extension Services								
Never	18	52.9	0	0.0	1	2.9		
When pond was being dug	10	29.4	9	26.5	9	26.5	49.6	***<0.001***
During harvesting	3	8.8	4	11.8	1	2.9		
Every 3 months or on demand	3	8.8	21	61.8	23	67.6		

Table 4.5.3: Chi-Square – Cost Performance by Location

	Project Location (District)						Chi-Square Statistic	p value
	Kikuyu		Githunguri		Lari			
	Freq.	Percent	Freq.	Percent	Freq.	Percent		
Draining and refilling the pond per year								
Three or more times	3	8.8	8	23.5	2	5.9	7.8	0.255
Twice	0	0.0	1	2.9	0	0.0		
Once	1	2.9	1	2.9	1	2.9		
No time	30	88.2	24	70.6	31	91.2		
Marketing Cost								
Above 1,200/=	2	5.9	1	2.9	0	0.0	6.5	0.374
600/= to 1,200/=	1	2.9	0	0.0	2	5.9		
1/= to 599/=	2	5.9	6	17.6	6	17.6		
0/=	29	85.3	27	79.4	26	76.5		
Number of man days for cleaning the pond								
10 and above workers	0	0.0	0	0.0	0	0.0	3.2	0.53
7-9 workers	0	0.0	1	2.9	0	0.0		
4-6 workers	6	17.6	3	8.8	4	11.8		
1-3 workers	28	82.4	30	88.2	30	88.2		
Number of man days for harvesting								
10 and above workers	0	0.0	1	2.9	0	0.0	11.7	0.07
7-9 workers	3	9.1	3	8.8	0	0.0		
4-6 workers	20	60.6	28	82.4	27	79.4		
1-3 workers	10	30.3	2	5.9	7	20.6		

Table 4.5.4: Chi-Square – Schedule Performance by Location

	Project Location (District)							
	Kikuyu		Githunguri		Lari		Chi-Square Statistic	p value
	Freq.	Percent	Freq.	Statistic	Freq.	Percent		
Length of wait after order for fingerlings								
5-6 weeks	2	5.9	11	32.4	16	47.1	54.2	***<0.001***
3-4 weeks	1	2.9	13	38.2	13	38.2		
1-2 weeks	7	20.6	6	17.6	4	11.8		
Below 1 week	24	70.6	4	11.8	1	2.9		
Age of fish in months at first harvest								
18 and above months	3	8.8	1	2.9	11	32.4	26.1	***<0.001***
14-17 months	0	0.0	5	14.7	2	5.9		
10-13 months	11	32.4	17	50.0	15	44.1		
Below 10 months	20	58.8	11	32.4	6	17.6		
Number of harvests per year including first harvest								
1	3	8.8	3	8.8	2	5.9	17.2	***0.009***
2	8	23.5	9	26.5	20	58.8		
3	7	20.6	13	38.2	8	23.5		
4	16	47.1	9	26.5	4	11.8		

Table 4.5.5: Chi-Square – Project Output by Location

Baseline Factors	Project Location (District)						Chi-Square Statistic	p value
	Kikuyu		Githunguri		Lari			
	Freq.	%	Freq.	%	Freq.	%		
Initial stock of fingerlings								
100-349	1	2.9	0	0.0	0	0.0		
350-549	1	2.9	6	17.6	19	55.9	40.1	***<0.001***
550-749	1	2.9	0	0.0	5	14.7		
750-1000	31	91.2	28	82.4	10	29.4		
Stock sold per year (relative to the initial)								
1-25%	8	23.5	24	70.6	7	20.6		
26-50%	25	73.5	9	26.5	20	58.8	30.1	***<0.001***
51-75%	0	0.0	1	2.9	4	11.8		
76-100%	1	2.9	0	0.0	3	8.8		
Average weight of fish at harvest								
1-250g	5	14.7	5	14.7	0	0.0		
251-500g	23	67.6	27	79.4	27	79.4	10.1	***<0.001***
501-750g	5	14.7	2	5.9	7	20.6		
751-1000g	1	2.9	0	0.0	0	0.0		
Target market for the fish								
Neighbourhood	7	20.6	13	38.2	25	73.5		
Mama Samaki (fryers)	0	0.0	0	0.0	1	2.9	25.1	***<0.001***
Fishmongers (Butcheries)	4	11.8	6	17.6	2	5.9		
Hotels	23	67.6	15	44.1	6	17.6		
Distance from Market								
22Km and above	7	20.6	13	38.2	5	14.7		
15-21Km	2	5.9	1	2.9	2	5.9	5.7	0.459
8-14Km	3	8.8	2	5.9	3	8.8		
0-7Km	22	64.7	18	52.9	24	70.6		
Estimate (no. of pieces) of fish eaten on the farm per year								
Over 100 fish	9	26.5	4	11.8	0	0.0		
71-100 fish	2	5.9	3	8.8	2	5.9	16.9	***0.01***
31-70 fish	2	5.9	10	29.4	6	17.6		
30 fish and below	21	61.8	17	50.0	26	76.5		

Table 4.5.6a: Chi-Square – Observation Variables by Location

		Project Location (District)							
		Kikuyu		Githunguri		Lari			
		Freq.	Percent	Freq.	Percent	Freq.	Percent	Chi-Square	P value
Observed evidence of Feeding records (if any)	None-existent	18	52.9	7	20.6	3	8.8		
	Verbal presentation (Mental records)	2	5.9	19	55.9	5	14.7		
	Verbal presentation (Inaccessible records)	3	8.8	5	14.7	23	67.6	62.9	**<0.001**
	Physical presentation (Accessible records)	11	32.4	3	8.8	3	8.8		
Observed evidence of Sampling Records (if any)	None-existent	16	47.1	18	52.9	26	76.5		
	Verbal presentation (Mental Records)	13	38.2	11	32.4	4	11.8		
	Verbal presentation (Inaccessible Records)	2	5.9	4	11.8	2	5.9	9.6	0.143
	Physical presentation (Accessible Records)	3	8.8	1	2.9	2	5.9		
Observed evidence of Sales records (if any)	None-existent	13	38.2	13	38.2	2	5.9		
	Verbal presentation (Mental Records)	6	17.6	15	44.1	4	11.8		
	Verbal presentation (Inaccessible Records)	0	0	2	5.9	24	70.6	68.3	**<0.001**
	Physical presentation (Accessible Records)	15	44.1	4	11.8	4	11.8		
Observed consistency of Feeding record keeping through project life cycle	None-existent	17	50	18	52.9	3	8.8		
	Initial Records only	1	2.9	7	20.6	2	5.9		
	Partial Records	0	0	5	14.7	0	0	46.4	**<0.001**
	Up to Date Records	16	47.1	4	11.8	29	85.3		

Table 4.5.6b: Chi-Square – Observation Variables by Location (Cont'd)

Observed consistency of Sampling record keeping through project life cycle	None-existent	15	44.1	21	61.8	27	79.4	24.5	**<0.001**
	Initial Records only	1	2.9	6	17.6	1	2.9		
	Partial Records	4	11.8	5	14.7	0	0		
	Up to Date Records	14	41.2	2	5.9	6	17.6		
Observed consistency of Sales record keeping through project life cycle	None-existent	13	38.2	24	70.6	3	8.8	43.7	**<0.001**
	Initial Records only	0	0	1	2.9	1	2.9		
	Partial Records	1	2.9	5	14.7	0	0		
	Up to Date Records	20	58.8	4	11.8	30	88.2		
Observed attitude to Record keeping	Records are not necessary	11	32.4	13	38.2	1	2.9	35.2	**<0.001**
	Records are necessary but too difficult to keep	5	14.7	13	38.2	4	11.8		
	Records are necessary but kept if time allows	10	29.4	6	17.6	25	73.5		
	Records are critical and always kept	8	23.5	2	5.9	4	11.8		
Pond Security (Perimeter fencing)	None-existent	7	20.6	31	91.2	26	76.5	41.5	**<0.001**
	Partially secured	7	20.6	1	2.9	1	2.9		
	Secured but needs reinforcement	9	26.5	1	2.9	2	5.9		
	Fully Secured	11	32.4	1	2.9	5	14.7		
Pond Security (Overhead fencing)	None-existent	22	64.7	31	91.2	32	94.1	16.8	**<0.001**
	Partially Secured	2	5.9	2	5.9	0	0		
	Secured but needs reinforcement	4	11.8	0	0	0	0		
	Fully Secured	6	17.6	1	2.9	2	5.9		

Table 5.3.1: Logistic Regression Model

Parameter	ODDs	se	95% CI	p value
Age	1.2	0.2	0.9 - 1.8	***0.018***
Region				
Kikuyu	0.2	0.1	0.1 - 0.8	***0.018***
Githunguri	0.2	0.2	0.1 - 0.9	***0.027***
Lari	0.2	0.2	0.0 - 1.0	0.056
Gender (male)	12.1	0.5	1.4 - 104.2	0.024
Education Level				
Primary	0.004	0.003	-	0.988
Secondary	0.003	0.002	-	0.987
University	0.003	0.002	-	0.987
Year of Start				
2009	0.3	0.4	0.3 - 3.0	0.317
2010	0.2	0.2	0.0 - 2.0	0.175
2011	0.4	0.4	0.0 - 3.6	0.402

Appendix X: INTRODUCTORY LETTER

Elizabeth Wanda Mutisya
Tel. 0735-720098
P.O. Box 24355-00100
NAIROBI

Dear Sir/Madame,

My name is Elizabeth Wanda Mutisya, a Masters student at Kenyatta University. I am carrying out an interview survey among the pond fish farmers in Kikuyu, Lari and Githunguri districts, Kiambu County.

You have been recommended by the District Fisheries Officer as one of the farmers who will take part in the survey because of the wealth of knowledge that you have in fish farming.

The purpose of this study is to find out how farmers are monitoring and evaluating implementation of their fish projects and how this affects the performance of the projects.

The study is important because it will show how farmers can assess project performance and put corrective measures in place to ensure it is profitable enough to form a lasting source of income.

Please note that all information you give me will be treated as confidential. Thank you for allowing me to interact with you during the course of this survey. Once completed, I am committed to share the results of this study with you in case you want me to.

Yours faithfully,

Elizabeth Wanda Mutisya.
RESEARCHER Date: .....