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State and private sector investments in community irrigation schemes in Mozambique: challenges and solutions

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ABSTRACT

There is an increasing state and private sector investment in community- irrigation schemes in Africa. Both governments and private sector investors are equally concerned about the willingness to pay and affordability of such schemes to local farmers. Others are equally concerned about sustainability of public investments in irrigation infrastructure, production enhancement, operation and maintenance costs, climate variability, market failure, externalities, decreasing marginal costs and cost recovery. Investors are worried about return on investments (ROI) when investing in such risky areas and advise farmers and government to use appraisal tools such as net present value (NPV), internal rate of return (IRR) and accounting rate of return (ARR). In a study conducted in three provinces of Mozambique, Maputo, Sofala and Zambezia involving five districts (Boane, Magude, Manhica, Gorongoza and Mopei) where questionnaires and interviews were conducted with 281 farmers, it was established that farmers were not willing to pay operation and maintenance costs, embarked on collective action, thus frustrating the government's efforts to recover costs. There is an increasing perception that community irrigation schemes remain reliant on state subsidies and financial analysis projected through NPV, IRR and ARR is not often translated into sustainable return on investment (ROI) for both the private sector and government investors. This paper looks at strategic investment initiatives of the Government of Mozambique and the private sector in terms of yielding sustainable irrigation and agricultural outputs and ensuring long-term benefits for both farmers and investors. The paper attempts to balance issues of investment appraisal systems and endogenous factors that are relevant in dealing with irrigation schemes.

Introduction

According to Sari Jusi, Maarit Virtanen, (2005:1) there is a global recognition that agricultural growth has been the engine of overall economic growth in the past. Thus it is also recognized that water is an essential input into agricultural production. Water infrastructure development plays a central role in reducing poverty and achieving sustainable economic growth. Given this situation, investment in irrigation infrastructure and technologies have become a major focus of government programmes and attention has been given to increasing the use of water-"saving" technologies among irrigators. Nevertheless, irrigation projects have suffered from low levels of maintenance and operation. Communities and small-scale farmers are expected to contribute towards operation and maintenance of irrigation infrastructure without the assistance coming from state institutions. In this regard, this research seeks to provide a clear understanding of how the Government of Mozambique (GoM) through the Ministry of Agriculture (MINAG) is addressing the public investment in water infrastructure for enhancing farmers' income and what is the farmers' perception regarding the usefulness of the infrastructure on improving the welfare of the subsistence farming communities. It also examines how community-based management could ensure long life and sustainability of the developed infrastructure.

African countries lack water infrastructure to provide storage to mitigate the variability of rainfall and increasing the control of water resources. The other challenge remains the lack of a direct method for managing the risks associated with climate variability and water storage is the most common approach to increasing water control, (Brown and Hansen, 2008:8). Thus, poverty alleviation has always been an important aim of the governments of developing countries when investing in the development of irrigation infrastructure (Figure 1.1).

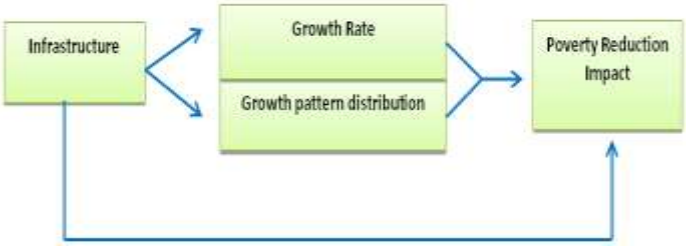

Figure 1. 1 Infrastructure Impact on Poverty Reduction
Source: Myanmar, (2004:20).

According to Myanmar (2004:1), international experience has led to a renewed focus on the agricultural sector as the engine for broad-based economic growth compared to any other sector within an economy. Therefore, growth in agriculture productivity has been recognized to be pro-poor, having a direct role in raising real incomes of the rural poor, and thus reducing

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poverty. This implies that in a sector such as agriculture, which requires relatively high public investments, strategically formulated interventions and policies conducive to growth could significantly contribute to the overall poverty alleviation. This is especially true in a country such as Mozambique where a major proportion of the population is based in rural areas.

There are contradictions that remain regarding cost recovery that is advocated for by proponents of trade liberalisation and new public management and proponents of a developmental state that intervenes in economic development and planning. Proponents of trade liberalisation and market fundamentalism are of the view that investment in irrigated agriculture in Mozambique has been faced with frustrating results related to low cost recovery rates, deficient operation and maintenance and therefore total irrigation systems collapse. In many instances, this has been associated with the lack of beneficiaries' capacity to operate complexities of infrastructure management in a variety of aspects (engineering operation, operations management, business organization, etc.). Such views are the reasons the government is calling for community management of the irrigation schemes in order to ensure economic growth. According to Sirte, Libyan Arab Jamahiriya, (2008:2), Mozambique's GDP was US$7.6 billion in 2007, and the value added by agriculture was 27.4% of the GDP in 2006. Agriculture provides work for 80% of the economically active population, and 60% of the people working in the sector are females. The agriculture sector comprises two categories of producers: the smallholder "family" sub-sector and the commercial sub-sector. The smallholder sub-sector which is the focus of this study, accounts for about 95% of the area under production. The service delivery for the irrigation sector is reduced and their quality is not the best yet. This is associated with the reduced number of expertise and service providers in the relatively small market for irrigation. At a provincial level there are few operators and their experience in conducting hydraulic works and infrastructure management is limited.

Recently, the government, through the Ministry of Agriculture established the National Irrigation Institute with a mandate to ensure the design of public irrigation infrastructure. Their implementation and management of its operations is aimed at enhancing sustainable and feasible operations. There is a need to investigate the causes of the collapse and failure of previous programmes or development of infrastructure with public investment in the irrigation sector. There have been several public investments on the agriculture industry in Mozambique focusing on hydraulic infra-structure and technologies that promote and improve the efficiency of water use as a key production factor acting on productivity enhancement in the agriculture production. Nevertheless, the feedback on the rural economy is still unsatisfactory and continues to worry the authorities and managers of the Ministry of Agriculture who are committed to achieving the millennium development goals (MDGs) on food security. During the last 10 years, the Government of Mozambique has invested about 200 million U.S. dollars for the development of public irrigation infrastructure and the World Bank is currently investing close to US$ 100 million for implementation of sustainable irrigation development projects.

The irrigation potential is estimated to be 3 072 000 ha. Presently, irrigated areas are occupied by smallholders and agricultural enterprises. Small-scale irrigation exists everywhere in the country, with schemes either abandoned or partly utilized. Most of the schemes are in a bad to a very bad condition, and only a relatively small part of the irrigation schemes is actually irrigated. There is a view that failing to sustain a cost recovery of the investment is affecting the sustainability of such schemes. Currently, 118 120 ha are equipped for irrigation, of which 49,000 ha are actually irrigated, consisting mainly of large schemes over 500 ha. The question rising to be understood is why so many investment initiatives fail to bring about desired results? Is the reason related to bad selection of the beneficiaries or poor services provided by the irrigation agency or other externalities? This paper is divided into four sections: introduction, research methods adopted, conceptual framework, results and conclusions.

Research Objectives, Research Questions and Methodology

The research objectives of this study are four fold:

1. To determine the perception of customers regarding the investments on agriculture water infrastructure development and the service delivery by the Ministry of Agriculture.
2. To examine the efficiency of community based management strategy by the infrastructure investment beneficiaries regarding investment profitability on water infrastructure.
3. To determine the affordability and willingness of the public investment beneficiaries in the agriculture industry to contribute towards cost recovery of the investments.
4. To provide recommendations to Government irrigation sector executives on how to address water for agriculture infrastructure investment to ensure successful investment infrastructure project implementation with best quality services delivery, providing high satisfaction and delight to beneficiaries farmers/ customer.

Research Questions

1. What is the perception of the rural communities, farmers, regarding public investment allocated to water management infrastructure and related service provision and how do the policies and Government investment strategies and decision making process through the Ministry of Agriculture are addressed in the irrigation sector development in Mozambique?
2. How efficient is the community-based management strategy on managing the public infrastructure developed through public investment in the agriculture sector in Mozambique?
3. What is the extent of affordability and willingness of the rural communities to pay for their water bills and cost recovery of the investments in irrigation scheme's infra-structure development using their farming incomes at developed schemes?
4. What measures can Government through the Ministry of Agriculture (Irrigation Agency) take to address sustainable public investment in irrigation infrastructure development and management based on best quality public service provision in the irrigation sector in Mozambique?

Target Population

The target population for this study is the people working in the agriculture industry, especially those utilizing public provided water infrastructure and services.

Table 1. 1. Target population and location

Country	Province	District	Irrigation Site	Total Population	Total Sample	Sample per site
Mozambique	Maputo	Boane	Mafuiane	200		54
			Manguiza	100		27
			Massaca	150		40
		Magude	Macuvulane	300		80
			Maguigune	150		40
		Manhiça	Xihenyissa	50		13
	Sofala	Gorongoza	Nhabirrira	50		13
	Zambézia	Mopeia	Limane	50		13
Total				**1050**	**281**	**281**

For this survey the total population is estimated to be 1050 farmers from eighth main public developed water infrastructure, as shown in Table 1.1.

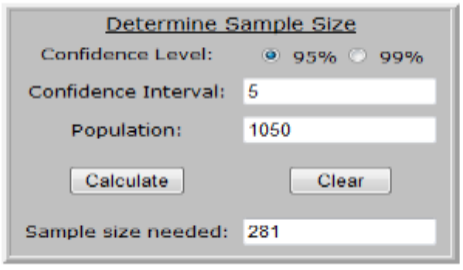
Sampling in this study

The present study adopted the simple random sampling technique to draw the sample. This is one of the probability sampling techniques, which is very simple to implement, provided that the population of the study is relatively homogeneous. In fact, the farmer beneficiaries of public irrigation infrastructure development in Mozambique may be considered as being relatively homogeneous in their most relevant characteristics, namely (i) socio-demographic characteristics (age, occupation, educational background, family size, sources of income, standard of living), (ii) type and scale of agricultural farming (how big is the cropland, height of the crop land, types of crops, cost of production), (iii) present source and nature of irrigation water (cost per unit, types of ownership, major advantages and disadvantages of the present irrigation water source) and (iv) their willingness to pay (WTP) for irrigation water infrastructure and services delivered.

Nonetheless, considering resources and time constraints, the simple random sampling technique was considered appropriate for this study. It has been possible to use the simple random sampling because a sampling frame, which consisted of a list of all public developed irrigation infrastructure by the Ministry of Agriculture and all farmers engaged on these public- developed water infrastructure for agriculture utilization in Mozambique, was available from the Ministry of Agriculture and its provincial affiliates and districts. To draw the sample, the random numbers table was used.

Sample size

Due to resources and time constraints, and the dependence on the willingness of respondents to participate in this study, a sample size of 8 water infrastructure developed through public investment, operated by about 1050 farmers was selected. Although being relatively small, this sample size was deemed sufficient to allow for statistical tests to be done reasonably.



The sample size was generated using a web based software Sample Size Calculator developed by Creative Research Systems. Considering a population size of 1050 farmers, 95% of confidence level and ±5% of confidence interval, the sample size is estimated to be 281 farmers that were interviewed. The box on the right shows the screen where sample size was generated at Venture data [online] available from: http://www.researchinfo.com/docs/calculators/samplesize.cfm (accessed on August 9th, 2012)

The sampling was done proportionally to the size of the population on each specific irrigation scheme. This allowed all schemes to be included in the sample by having all strata that are representative for each considered groups. The chosen method allowed better analysis of the answers from the respondents including strata comparison, correlation, and perform analysis per strata in case of high variance resulting from different trends among strata. A questionnaire comprising two parts was constructed for collecting data. The first part is designed to gather information from farmers working in irrigated agriculture, those that benefited from public investment on irrigation infrastructure and those seeking to measure their perception regarding public investment in water infrastructure for agriculture production, production capacity enhancement through water uses, their willingness to contribute towards cost-recovery specially O&M for infrastructure operation. This questionnaire consists of three sections.

To understand how organisational pre-decision control mechanisms might influence managerial behaviour at the various stages of the strategic investment decision-making process, each of these pre-decision control dimensions were considered in relation to the questions posed in the questionnaire.

The questionnaire, seeks to bring information regarding:

- Managerial participation and the use of formal procedures,
- The use of financial analyses,
- Manager's perspectives on project fit with organisation's strategy;
- Manager's perception of key indicators of a capital project contribution to government objectives ;
- Manager's perspectives on project approval hierarchy;

A pilot study was conducted prior to the main study data collection process. The aim of the pilot study was to assess the adequacy of the data collection instrument in terms of its validity and reliability. In addition, the pilot study aimed at assessing whether the data obtained help in responding to the research questions, and are in line with the research objectives. The pilot study also helped in testing out the computational procedures and appropriateness of the chosen statistical data analysis techniques for this study. A sample of two public-irrigation infrastructure developed through public investment in Mozambique was conveniently selected for the pilot study. Cooper and Schindler (2003:86) indicate that a sample size for pilot study may range from 25 to 100, depending on the main study sample size. Fink, cited in Saunders et al. (2003:309), asserts that, in many student questionnaires, the minimum sample size can be kept at 10. Thus a sample size of 10 farmers interviewed in two irrigation schemes constitutes 25% of the total sample of 8, which was deemed acceptable in this pilot study.

The data gathered during the pilot study were submitted to statistical analysis, whereby cross-tabulation showing the frequencies of question-by-question responses and their respective percentages were performed. The Pearson correlation analysis was performed to check the relationship among the variables being investigated. At this stage, the internal consistency of the questionnaire, that is, the extent to which the questionnaire items hang well among themselves was evaluated. The idea was to assess how well the items that reflect the same construct (irrigation infrastructure performance) yielded similar results. In this respect, the Cronbach's coefficient alpha was determined, using the SPSS statistical software.

Cronbach's alpha is a measure of internal consistency and is the most widely used and reported method for estimating the reliability of questionnaires (Shoemaker, 2006:2). The value of this coefficient varies from 0 to 1 (Gliem and Gliem, 2003:87). An instrument is deemed reliable when the value of Cronbach's alpha coefficient approaches 1. The literature indicates different values for an acceptable Cronbach's alpha coefficient. For example, Nunnaly, cited in Santos (1999), indicates Cronbach's alpha coefficient value of 0.7 to be an acceptable reliability coefficient, while George and Mallery, cited in Gliem and Gliem

(2003:87) indicate the value of 0.6 as being acceptable. In the pilot study, the questionnaire's internal consistency analysis yielded a Crobanch's alpha of about 0.8, which is deemed acceptable. The alpha value of 0.8 obtained in this analysis suggests that the questionnaire was quite reliable, that is, the items used in it provided a reliable measurement of irrigation infrastructures performance and farmers perception of the usefulness of the investment. However, two items presented a negative correlation coefficient, which, according to Zencaroline (2007:3), indicates the need to recode the item in opposite direction. Nonetheless, the questionnaire was not altered, as it was felt that the pilot study used only 10 observations, which might have produced some misleading information.

It is worth mentioning that there is only one question that the producers could not answer or felt not comfortable in responding this was related to the annual revenue after marketing their production. Thus, while the relevance of this question was to gauge their abilities to pay the costs recovery on it various facets of the system, this question has changed and adjusted to reap only the information whether producers could sell all their production or not, on the assumption that selling their entire production, so has the ability to pay all costs associated to production including those of water infrastructure utilization.

Data analysis

The data collected through questionnaire were edited and coded before feeding them into the computer for analysis. SPSS statistical software for windows, version 18.0 was used for data analysis. During data entry into the computer, identification number as assigned to each survey form was also entered. In this way, it was possible to track the original data from the questionnaire when a mistake or error was detected during data entry. Prior to analysis, data were checked for possible errors. For this research, categorical and numerical data was collected. Both qualitative and quantitative data analysis, descriptive and inferential statistics was carried out, including hypothesis testing, using a statistics package such as SPSS18. This package allows the information to be presented in tables and a cross tabulation between different variables can be assured in order to specify the answers the study is looking for.

Frequency and correlation analysis was performed to measure the farmers / respondent view of the importance of irrigation water in increasing agricultural production and in raising their incomes and their perception of involvement in investment decision making process. This study has drawn on a combination of survey results and semi-structured interviews to explore managers' perceptions of how these perceive the extent to which pre-decision controls influence strategic investment decisions. Therefore, the use of follow-up interviews added depth to the survey results by probing exactly how and why managers perceive the extent to which pre-decision controls influence their decision-making behaviour.

Informed consent

In this research, an effort was made to ensure that all managers were informed about the survey prior to starting the study. This was made through a memorandum advising them about the inclusion of their firms in the study sample, and outlining the nature, purpose, and requirements of the study. The memorandum also stressed that the participants could help with their opinion and knowledge in the subject matter of this study. The respondents were also informed that the participation in this study, would involve sparing some little time to honestly filling in a short questionnaire. It was emphasized that they were not obliged to take part in this study, neither were they forced to answer the questions of the survey, but they could only do it if they so wished. This also helped to ensure that the answers to the questionnaire were honest.

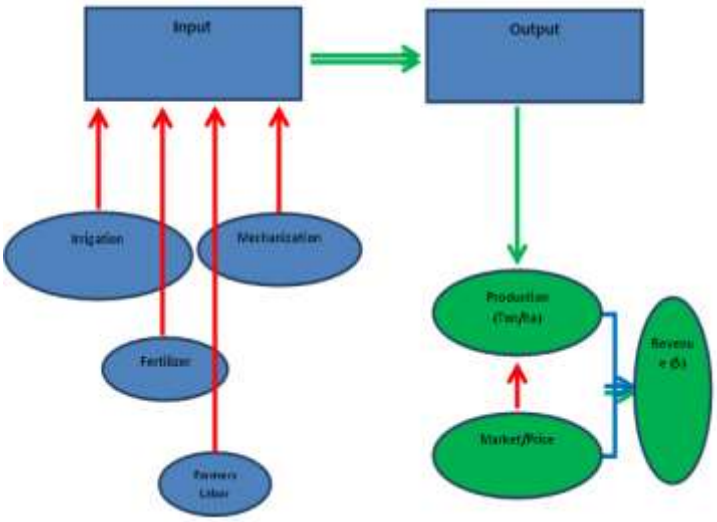
Another important aspect here is that participants were assured that the confidentiality of information they provided would be maintained, and their identity and that of their irrigation site would not be revealed in any instance of the study process. In addition, participants were informed that the questionnaires with their answers would be destroyed after the data was edited and processed statistically for the study. The participating respondent's rights to anonymity as well as confidentiality of the information provided were maintained. For example, respondents did not have to put their names nor did they have to indicate the names of their irrigation scheme in the questionnaire. As far as benefits are concerned, it was emphasized that a summary report of the study findings would be provided to the participating irrigation sites.

Theoretical Framework

Investing in Irrigation and Production Enhancement

According to Sirte, Libyan Arab Jamahiriya, (2008:5), a major challenge is posed by the deteriorating status of the agricultural water infrastructure, requiring investment and technical assistance for its rehabilitation as well as maintenance and operations with the focus clustered around three main objectives that include to generate and support demand driven irrigation investment, provide reliable and cost-effective irrigation services, and to promote an enabling environment for progressive commercialisation. The World Bank's rural strategy, *Reaching the Rural Poor*, recognizes that water is an essential input into agricultural production, as well as the basis for livelihoods of rural communities. Thus efficient agricultural production for local and export markets is increasingly important for economic growth and poverty reduction. If farmers raise the value of water in irrigated agriculture, they will increase the crop yields which in turn produce larger farm incomes and increase the economic productivity. Therefore, there is a greater incentive to invest in irrigation infrastructure where its economic return is highest. This occurs where the infrastructure increase crop yields and save water (Ward, 2010:330). Thus, representing the efficiency of water uses in agriculture production or the contribution on irrigation in yield production as shown in figure 3.1

Figure 3. 1 Agricultural production model



Source: Ward (2010)

According to Nyoni, (1999:446), and as per World Bank report (2008) all users of public water infrastructure should pay

for its cost recovery. This cost recovery can be viewed from various angles, namely full cost recovery and economic cost recovery. Notwithstanding, there is variation on what can be deemed a fair price and farmers' ability and their willingness to pay. Nyoni, (1999:451) states that the rationale for economic pricing cannot be over emphasized. From an economic point of view, the pricing of water nonetheless reminds the users of the scarcity also guarantee the cost of its provision, which call for adequate revenues with which to operate, maintain, improve and extend the system. Thus it is apparent that all sectors of the farming community attach some "economic value" to water and water infrastructure in order to increase the value of crop production, farmers' incomes; and food security. Nevertheless, specific national objectives will justify modifications to the strict water pricing rationale. Ahmed, (2003:267) argues that the process of agricultural technology and growth has remained outside the concern on most development economists, thus the critical factor for raising productivity is technical change; therefore, the role of government to promote the technical change by investing in irrigation technology, research and public services delivery.

Ahmed, (2003:267) states that bureaucratic public sector agriculture research system in most African countries consistently fail to serve the majority of small farmers effectively, thus the purpose of the farmers' participation in agricultural technology development geared towards involving small farmers as active decision makers in the development and transfer on new technology which prevent poor returns. According to Tapela (2008:182), irrigation farming is widely seen as having a significant potential to enhance rural development, reduce poverty and increase small-scale farmers' productivity, employment and incomes. Key questions therefore are whether farmers will be able to pay for irrigation services and cost recovery. However, substantial components of public goods investment decision-making are top down, potentially leading to mismatches between public investment projects and the demands of local residents. Misallocation of public good investment resources may severely hinder achievement of the economic and social goals that motivate those transfers. (Yi, Hare and Zhang, (2010:115). Malik (2008:6) states that irrigation accounts for 70 to 90% of total water use in developing countries and for more than one third of water use in many Organization for Economic and Cooperation Development (OECD) countries. Thus, irrigation has also been credited with helping to increase the incomes of farmers, in tackling problems of rural poverty and in keeping prices of food lower than they would otherwise be.

According to Malik (2008:7), the world over, most irrigation systems have been built and operated by government agencies and water users are charged only a fraction of the cost recovery generally based on the area irrigated rather than on the amount of water used which in many cases, fail to even cover operation and maintenance (O&M) costs. Therefore, extensive contributions from governments' public investment and current expenditure budgets have been necessary to maintain irrigation systems to avoid long-term deterioration of irrigation infrastructure. The provision and use of irrigation water are associated with a number of externalities, both economic and environmental, whose costs have to be borne by governments or society. Irrigation water use is also associated with significant opportunity costs. In the cost recovery view, while some estimates equate cost of irrigation with only the current O&M cost of irrigation works, others equate irrigation cost with O&M cost plus some fraction of capital cost without clarifying how the costs of multi-purpose projects have been apportioned and how the capital invested in the past has been accounted for. Thus, for either economic or political reasons, the full cost of providing irrigation is never recovered. Since only a part of the cost is recovered, an amount of subsidy is therefore always built into the provision of irrigation water.

In practice, most countries seek only to recover annual O&M costs and possibly some fraction of capital investment costs. Given the mounting load of irrigation subsidies in many countries, almost all countries have undertaken to recover at least the O&M cost of the irrigation systems from the users. Given that the raising of irrigation prices can be a politically sensitive issue, limited success has been achieved in improving O&M cost recovery. Some parts of the world, such as the European Union (EU), are now moving towards full cost recovery. China has also shown its intent in moving towards a system of full cost recovery. Bosworth (2004:22) argues that water pricing reform is often driven by pressure on government budgets, rising costs to provide water delivery services and governments' desire to recover all or part of their costs. For several years the World Bank has encouraged governments to employ a policy of cost recovery in the belief that users should pay fees to cover O&M costs and some of the capital costs. Thus, cost recovery requires a politically sensitive choice as to the extent of cost recovery, full recovery of capital and O&M costs at realistic interest rates, or partial recovery, implying some level of explicit or hidden subsidy. Where capital costs and O&M costs are not recovered, governments pay the difference, thus subsidizing the agricultural sector, which is a politically sensitive area.

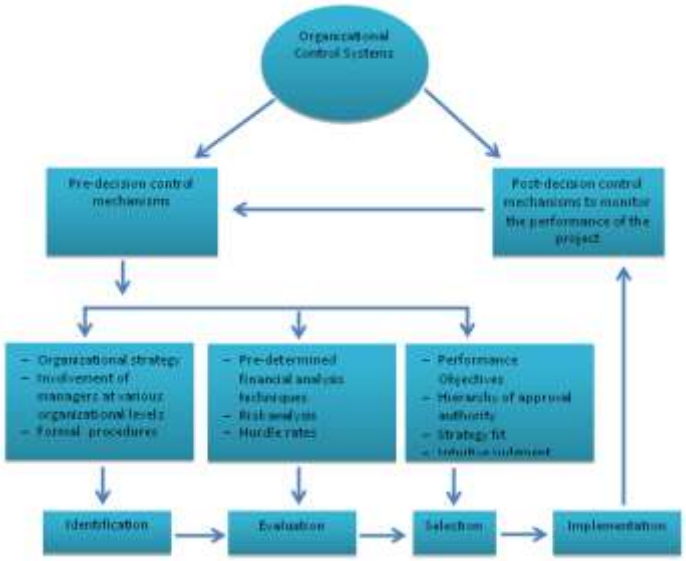
Wai Fung Lam, (2006:163) argue that the huge investments in irrigation systems have been taken out over the world, however, have not brought about satisfactory performance in many cases. Thus, many irrigation infrastructures developed through public investment have failed to generate a rate of return that is at least equal to the opportunity cost of capital, and hence are economically non-viable due to both unrealistic cost-benefit analyses in the planning stage and defective engineering designs, affecting farmers ability, willingness to pay for cost recovery and technology acceptance and infrastructure operation and maintenance (O&M). In many systems, irrigation managers and farmers have failed to arrange an effective working order to operate the systems and to mobilize adequate resources to maintain the irrigation facilities. The sustainability of water infrastructures developed through public investment, hinges upon the abilities of individuals involved to coordinate with one another in managing the infrastructure's operation, maintenance, and use. Wai Fung Lam, (2006:164) argue that the bureaucratic mode of irrigation management does not work and in some instances has led many policy makers and policy analysts to conclude that government is irrelevant to irrigation management and, hence, should be excluded to the extent possible. Such a view, however, has been challenged by studies of social capital and development, which suggest that government-society synergy is instrumental to materializing development potentials in various domains of collective action which believes that a synergy between farmers and irrigation managers can help to bring about good irrigation performance.

It is now well accepted that government interventions to minimize inefficiencies have destabilized the capacity of rural communities to self-governance or collective action. Government involvement has also reduced the development of social capital. It has led to imperfect enforcement and corruption and exacerbates the distribution of benefits, Herath (2005:889).

Timmer (2008:73) believes that irrigation technology is the key to increasing yield, cropping intensity and production stability. Thus if the government wishes to revitalize the agriculture industry, it will need to rehabilitate and expand the irrigation infrastructure. Again, this is primarily a matter of public investment, although private farmers, organized into water-user groups, need to be actively involved in the design and management of these facilities. Indeed, evidence from the World Bank (2006) shows that the economic rates of return from such investments can be high when a participatory approach is taken towards rehabilitation. OEDC (2006:28) states that, infrastructure affordability can be significantly improved by taking a demand-led approach, defining appropriate service levels to raise low living standards. In fact, in agriculture there is no single correct answer. Approaches should be adaptable and rational, because agriculture is the science of locality and uncertainties. Solutions should promote longer- term strategies that take into account the heterogeneity of agriculture and farmers typology. A farm typology is a useful tool to identify and characterize farm diversity so that solutions can be offered to all farmers according to their feature. Recognizing these diversities, enhance the better understanding of the barriers to irrigation infrastructure investment, the consequences of development activities and what support is necessary to achieve sustainable irrigation infrastructure investment. Therefore, the farm typology helps decision makers to implement appropriate interventions in terms of resources, conditions and interests that are compatible with each identified class of farms. It also helps policymakers to identify priorities.

Strategic Investment Decision-Making

Alkaraan and Northcott, (2007:135) argue that as strategic investment decisions involve large sums of money and have a significant impact on the firm's competitive position and future operating performance, they constitute an important business activity over which effective control must be exercised to help ensure the quality of the investment programmes. Furthermore, strategic investments are substantial investments that involve high levels of risk and producing outcomes that are difficult to quantify, and have a significant long-term impact on corporate performance.



Source: Alkaraan et al. (2007:137)

Figure 3. 2. Strategic Investment Decision-Making Process

Thus, given the nature and impact of these investment decisions, they must be closely aligned to organisational strategy in order to advance the organisation's intended aims. Based on this, it is understood that, public investment in irrigation infrastructure seeks to enhance farmers' production capacity through introduction of new technology of water for agricultural development. In turn it will impact farmers generating a higher and sustainable income for the smallholder in targeted areas through improvements in agriculture production efficiency and marketing action.

Drawing on these factors identified in the literature, Figure 3.2 shows an overview of how organisational pre-decision control mechanisms might influence managerial behaviour at the various stages of the strategic investment processes. A discussion regarding strategic investment decisions has revealed that since effective investment decision making is vital for the long-term strategic direction of an organisation, it cannot be seen as an independent activity but is an integral part of an organization's strategy. In fact, institutions involved in government decision making regarding public investment, particularly those related to water infrastructure for agriculture empowerment, require strategic thinking approach mechanism and be decided in such a way that the desired impact on economy are achieved and farmers takes the full ownership of the infrastructure management and administration. Alkaraan and Northcott (2007:144) state that, an appropriate management control system is a key means of providing adequate strategic guidance to the investment process. Furthermore, while the use of financial analysis has been well examined in the capital investment literature, limited attention has been paid to other stages of the investment decision-making process (the initial development of investment proposals; early screening to ensure that they are compatible with organisational strategy; and those aspects of project selection that are shaped by prescribed evaluation and authorization routines). This study seeks to bring out those aspects related to investment proposal development and the edge of stakeholders' participation on the project design and strategy alignment to the couple stakeholders' expectation for addressing the problem. This includes the way public investments are addressed by the government departments in Mozambique for settling down the production problems and families' incomes raising in the rural areas.

Alkaraan and Northcott (2007:147) argue that strategic investment decision making draws on expertise from a range of personnel including production and marketing specialists, engineers, managers throughout the organisational hierarchy, and the board of directors. Although many prior studies have examined the impact of financial evaluation techniques on the investment choices made by these organisational actors, how investment decisions take shape depends also on the decision objectives, strategies and procedures employed to guide choices and to harmonize different views. This study has drawn on a combination of survey results and semi-structured interviews to explore managers' perceptions of how these pre-decision controls influence strategic investment decisions. The use of follow-up interviews added depth to the survey results by probing exactly how and why managers perceive pre-decision controls to influence their decision-making behaviour.

Public Investments Vs Private Investment

Investment in irrigation in this research means public expenditure on new irrigation systems (capital investment). A broader definition is used here to include public investment in irrigation and drainage development, modernization, institutional reform, improved governance, capacity building, management improvement, creation of farmer organizations, and regulatory oversight, as well as farmers' investment in joint facilities, wells, and on-farm water storage and irrigation

equipment. According to Erden and Holcombe (2006:486) while economists agree that investment has a positive effect on economic growth, they have not produced a consensus on whether public or private investment has a larger impact on economic activity and whether there is a link between the two. Nevertheless, that public investment may increase aggregate output and thus enhance the physical and financial resources in the economy. Therefore, public spending on infrastructure such as roads, highways, education, sewer and water systems, and power plants often results in a reduction in costs facing the private sector, complementing those by the sector (private investment) which raises the productivity of private capital. According to Herath (2005:883), neoclassical economics considers private property rights as the most efficient system of resource allocation. Therefore, only private property rights will further the markets and economic efficiency. Private property rights theorists state that in using common property, externalities are created which are not internalized, free riding and the degradation of the natural resource occurs. Furthermore, the theorem says that government involvement is not necessary if property rights are well established. In fact, when investing in public infrastructure, farmers organization and insight of the overall infrastructure need to be stimulated to ensure operational and sustainability which in turn ensure long life of the investment.

There are two major approaches to analysing the effect of public investment on economic growth. The first is based on the neoclassical production function in which public capital enters as a separate input and on the productivity measures derived from the production function. Therefore, public investment spending, particularly on core infrastructure, has a substantial influence on output and the productivity of private capital. However, some studies have found that public investment has a negligible impact on productivity and others found that for developing countries, although public investment contributes to the productive performance of the economies, private investment has more influence on economic growth, Erden and Holcombe (2006:576). Furthermore, Erden et al. (2005:576) believe that public investment in infrastructure is widely believed to exert a positive impact on private investment. However, public investment crowds out private investment, which would lead to substantially different policy conclusions with regard to public investment. This is an important and unsettled policy issue, which motivates this empirical examination of the effects of public investment on private investment in developing countries.

Public investment in agriculture water infrastructure

McClintock (2009:1) argues that investment in irrigation infrastructure and technologies, particularly those that reduce on-farm water use have become a major focus of government programmes both at a State and Commonwealth level. Particular attention has been given to increasing the uptake of water "saving" technologies among irrigators. The design of programmes capable of achieving government objectives at least costs requires an understanding of farm level investment decisions. Therefore, this study focused on aspects preceding investments on irrigation infrastructure to understand the shape that feature the investment in the country, including farmers' participation and the government decision making process. McClintock (2009:3) argues that much irrigation research focuses on improving decisions of agricultural water use, however, decisions about when to invest in a new technology also have an important bearing on improvements in water use efficiency and farm viability over the long term. Investments in irrigation technology are strategic decisions an irrigator makes to change or modify their production system. They are usually larger and longer term decisions as opposed to tactical decisions undertaken within a growing season in relation to the use of production inputs and crop marketing.

Traditional investment theory evaluates the present value of revenue against the present value of expenses associated with the investment. It states that if the net present value (NPV) of the project is zero or higher, the investment is viable and should go ahead. Conversely, projects with an NPV below zero should be rejected. According to Norris et. al. (2010:4), there is a broad consensus that a scaling-up of investment in low-income countries, particularly in infrastructure, is critical to achieve sustained growth. Nevertheless, the link with development outcomes depends critically on the quality and efficiency of public investment. In fact, the level in which investment objectives are achieved, determine the level of growth as a result of that investment. Ward (2010:324) states that where economic efficiency is an important objective than investments in irrigation infrastructure to enhance agriculture production will take place whenever the additional economic benefits they produce exceed the added costs. Nevertheless, the development and use of water and related infrastructure for irrigation is often accompanied by one or more of the classic kinds of market failure which include externalities, public goods, decreasing marginal costs, common property resources, and uncertainty. The presence of these market failures can produce an inefficient allocation of water and related taxpayer resources used to finance irrigation infrastructure. Externalities can result from either the development of water for irrigation or its allocation. According to Ward (2010:8), irrigation remains a key input for raising productivity across a broad range of lands; therefore, desired level of irrigation infrastructure investment can be based on many criteria, including economic efficiency, equity, sustainability and food security.

Key Economics Theories Impact in Irrigations

Market failure, Externalities and Public goods

Market failure is a concept within the economic theory describing when the allocation of goods and services by a free market is not efficient. Market failures can be viewed as scenarios where individuals' pursuit of pure self-interest leads to results that are not efficient and that can be improved upon from the societal point-of-view, (Morey 2012:7). Market failures are often associated with information asymmetries, non-competitive markets, principal agent problems, externalities, or public goods. The existence of a market failure is often used as a justification for government intervention in a particular market. Therefore, some types of government policy interventions, such as taxes, subsidies, bailouts, wage and price controls, and regulations, including attempts to correct market failure, may also lead to an inefficient allocation of resources, sometimes called government failure. A good or service could also have significant externalities, where gains or losses associated with the product are borne by people who did not sell or purchase the product. According to Morey (2012:3) external effects exist if the actions of one or more economic agents enter as direct arguments in the utility or production functions of other economic agents. Therefore, there is an externality if an economic agent(s) does something that directly influences (not indirectly through market prices) some other economic agent(s) and there is the potential to make one of the parties better off without making some of the others involved worse off.

Private goods are rivalrous (a unit of a good consumed by one person cannot also be consumed by another person) and

excludable (a person who does not pay for a good can be excluded from its consumption) in consumption. By contrast, a pure public good is non-rivalrous, a given amount of the good can be consumed by one person without affecting its simultaneous consumption by another, and non-excludable, non-payment does not entail exclusion from consumption. Within these poles of non-rivalrousness and non-excludability, impure public goods represent in between cases. Impure public goods arise because of congestion costs: the value to existing users of a public good falls as more users are added. Impure public goods are, therefore, partially rivalrous. Within this category of impure public goods, it is possible to distinguish between:

• Common property resources: public goods subject to congestion from which exclusion is not possible;
• Club goods: public goods subject to congestion from which exclusion is possible;
• Variable use goods: public goods subject to congestion where the amount of services used by consumers can be varied.

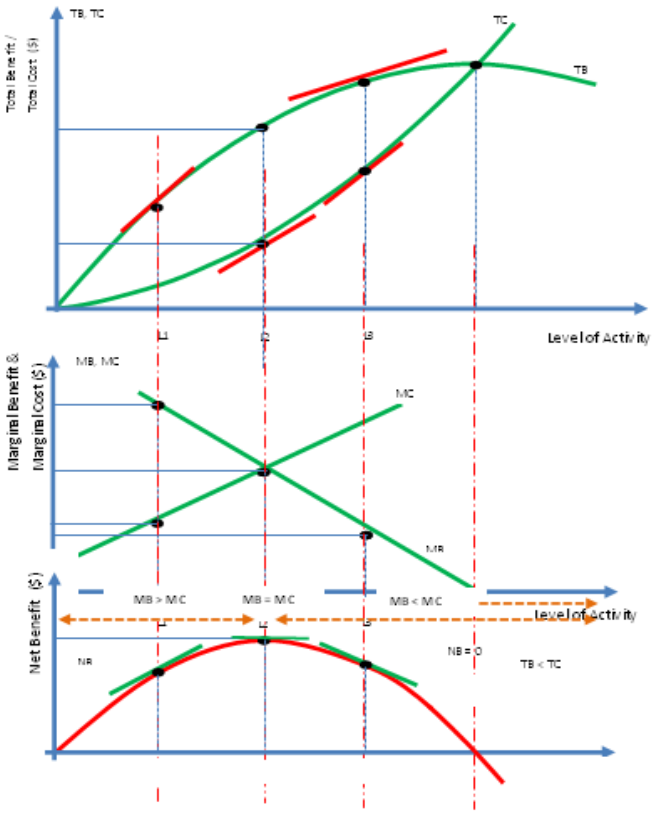
Common property resources

According to Morey (2012:3), a resource is common property if access to it is not controlled. That is, it is common property if no one effectively owns the resource. While few resources in this world are pure common-property resources (resources where access to them is completely uncontrolled), access to many environmental resources is largely uncontrolled, or controlled to only a limited extent. Morey (2012:21) argues that public commodities possess the property that multiple agents can consume the same units of the commodity. Therefore, the commodity is non-congestible in the sense that one agent's consumption of a unit does not preclude or impinge on another agent's consumption of that same unit. Thus most economists would agree that non-congestible is a necessary condition for a commodity to be a public commodity, but some economists would conclude it is not a sufficient condition. Some would add the property of non-excludable; non-excludable meaning that once units of the commodity are provided to one agent, no other agent can be excluded from consuming those same units. The definition of a public commodity can be further restricted by assuming, in addition to non-congestible and non-excludible, that everyone is forced to consume all units of the public commodity produced. Note that this last condition does not require that all are affected the same, but does imply non-excludible. The nature of irrigation infrastructure stands on middle of these theoretical definitions of goods. Irrigation infrastructure is public common goods. For addressing economic feasibility, the schemes are designed to operate on a cycle mode according to the irrigation schedule, imposing challenge to farmers for adequate and suitable management. Thus farmer's training will be major a challenge to develop local capacity to ensure local based management of these introduced new technology is developed and strengthened.

Decreasing marginal cost

Formulating an optimization problem involves specifying three things, namely, i) the objective function to be either maximized or minimized, ii) the activities or choice variables that determine the value of the objective function, and iii) any constraints that may restrict the range of values that the choice variables may take. Marginal analysis involves changing the value of a choice variable by a small amount to see if the objective function can be further increased (in the case of maximization problems) or further decreased (in the case of minimization problems). Therefore, net benefit from an activity (NB) is the difference between total benefit (TB) and total cost (TC) for the activity, Maurice (2008:72). Marginal benefit (MB) is the change in total benefit caused by an incremental change in the level of activity. Marginal cost (MC) is the change in total cost caused by an incremental change in the level of activity. An "incremental change" in activity is a small positive or negative change in activity, usually a one-unit increase or decrease in activity. Maurice (2008:75) state that because "marginal" variables measure rates of change in corresponding "total" variables, marginal benefit and marginal costs are also slopes of total benefit and total cost curves, respectively. Marginal benefit (cost) of a particular unit of activity is measured by the slope of the line tangent to the total benefit (total cost) curve at that point of activity. Thus, if, at a given level of activity, a small increase or decrease in activity causes net benefit to increase, then this level of activity is not optimal. The activity must then be increased (if marginal benefit exceeds marginal cost) or decreased (if marginal cost exceeds marginal benefit) to reach the highest net benefit. The optimal level of the activity is attained when no further increases in net benefits are possible for any changes in the activity. This point occurs at the activity level for which marginal benefits equals marginal cost (MB = MC), therefore, the manager should increase the activity if MB > MC and decrease the activity if MB < MC. The optimal level of activity is the last level for which MB exceeds MC.

Figure 3.3 Relation between total cost and Benefit with Marginal Cost and Benefit and Net benefit

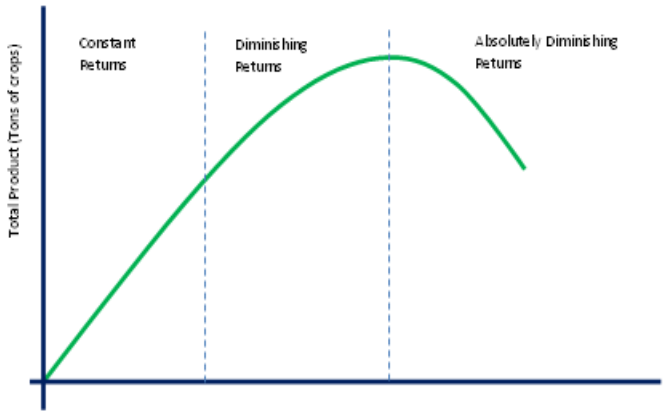


Source: Maurice (2008:85)

In economics, diminishing returns is the decrease in the marginal (per-unit) output of a production process as the amount of a single factor of production is increased, while the amounts of all other factors of production stay constant figure as indicated in figure 3.4. Indeed, improving water management commodities, through irrigation infrastructure, by adding more water to crops, will improves crop production on irrigated farms. But at some point, adding more and more water improves the yield less per unit of water, and excessive quantities can even reduce the yield. This means that there is knowledge to be

created to the water infrastructure beneficiaries related to the optimal irrigation schedule, which ensure maximization of irrigation commodities contribution and benefit. The optimal quantity of an activity is the level that generates the maximum possible total net gain. Graphically this point is shown in figure 3.4. This theory brings out the need for efficient and effective water infrastructure management, challenge farmers whilst taking into account that irrigation technology is any new method of doing business for most of farmers.

Figure 3. 4 Diminuishiong return



Source: Adapted from Maurice (2008:96)

The Perception of Customers Regarding the Public Investments in Agriculture

Ahmed (2003:270), state that when farmers perceive that the technologies transferred are of no significant returns compared to their traditional practices thus they do not value the technology and do not accept it. This draws attention to the decision-makers regarding the irrigation technology selection within government's public investments for farmers. Therefore, keeping farmers informed of the progress of work and maintaining regular and informative communication with them between project meetings is one of the key factors for investment success in water infrastructure development. This will be deeply investigated in this research based on the questions listed in the questionnaire to determine the degree of involvement of beneficiaries and involvement of technicians and stakeholders on several projects investment in irrigation sector and its degree of success on reaching the envisaged goals. Lam, (2006:164) refers to various forms of an irrigation agency organization, ranging from i) a government department formally established by laws; ii) a semi-governmental organization controlled by both farmers and government; and iii) a self-organizing entity controlled solely by farmers. Furthermore, Lam (2006:166) has recognized that irrigation agencies play an important role in irrigation management. While farmers might have great potentials in organizing water distribution and system maintenance at the sub-lateral level, it is unrealistic to assume that they can deal with all the problems they face in operating and maintaining the irrigation systems. In particular, management activities on the system level, such as the O&M of water infrastructure schemes, often require expertise and financial resources that farmers lack. Moreover, if effective management on the system level is not in place, farmers' self-organizing efforts on the sub-lateral level are unlikely to succeed. Thus, a conventional wisdom in public administration is that, in order to achieve the unity of command and to tap the economies of scale, an agency should be given the responsibility of managing a policy area inclusively.

The question that arises on this aspect of management of irrigation schemes by different entities and principles is if the management rules are studied and established before public investments in irrigation infrastructure or becomes issue to be established after the investment. Lam, (2006:169), refers to the fact that including O&M management functions into an all-inclusive agency also affects the incentives facing irrigation managers. Thus priorities are often given to construction works in financial allocation; O&M often receives resources left over by construction works, which often occupy a small proportion of the infrastructure development estimated budget. Moreover, given that irrigation engineers are trained to build things, O&M tasks are not likely to be considered prestigious in an irrigation agency. In fact, irrigation managers responsible for O&M are often required to stay in the rural areas where the systems are located. The living conditions in the rural areas are austere, thus, being assigned to the O&M section is often considered to be punitive.

According to McClintock (2009:17) where the expected net social benefits are sufficient and there is inadequate private incentive, there may be potential to hasten uptake of the technology through the use of cost sharing arrangements or other strategies such as publicly funded research and development to reduce the upfront cost or improve effectiveness of the technology. Notwithstanding, the use of government incentives to offset capital costs as a means of encouraging a more rapid uptake of technology must be carefully considered. Thus providing subsidies for technical efficiency in irrigation technologies, or for industries to increase productivity without targeting market failures or inadequate government policies, will reduce economic efficiency and involve wealth transfers from the public to benefiting irrigators.

Technology Acceptance Model and the Investment Decision

Taylor (2007:13) states that agriculture water infrastructure also is critical to improved productivity and yields, getting products to markets. Nevertheless, most of African agriculture is rain-fed and could be substantially more productive if water management infrastructure (irrigation technology) were more widely in place and perceived easy to manage and useful for farmer's production rise which would predicts attitude towards full use of a technology and farmers the behavioural intention to use its willingness to pay for cost recovery.

Figure 3. 3. The Technology Acceptance Model (TAM)

Source: Smith and Spiers (2009:160)

Smith and Spiers (2009:156) state that, the technology acceptance model (TAM) (figure 3.5) specifies the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude towards using, and actual usage behaviour of any technology introduction. Thus, the success of a introduced technology can be determined by user acceptance, measured by two variables, namely, i) the perceived usefulness of the infrastructure; and ii) the perceived ease of use. It can be argued that an irrigation technology developed through public investment should demonstrate

usefulness and ease of use act upon the filters, thereby acquiring the customer's (beneficiaries) attention and motivating them to use and maintain the system.

For the irrigation investment project, external variable referred to on the model, can be product services, which is associated with the Irrigation Agency quality services delivered to the communities benefiting of the public investment that will directly impact on the farmers' perception of the usefulness of the irrigation schemes. The irrigation technology usability is a major external variable affecting the farmers' perception of easiness of use of the technology. Thus both the perception of usefulness and easiness use of the scheme impact on the farmers' intention towards using the technology brought by the investment which on the other hand ensure the sustainability of the developed infrastructure. Porter and Donthu (2006:100) argue that there are two research paradigms that have emerged to explain technology adoption and acceptance. Using the first paradigm, researchers focus on trait variables to explain an individual's propensity to use new technology determined by technology readiness index which delineates two drivers, namely, optimism and innovativeness; and two inhibitors, namely, discomfort and security of an individual's propensity to use new technologies. In fact, irrigation technology on this paradigm can be perceived an optimum water facilities and or innovative and attempted to be perceived risk for traditional cropping community based management and uncomfortable to farmers. The second paradigm focuses on how a technology's attributes affect an individual's perceptions and, ultimately, use of that technology. Indeed, the TAM is the most widely applied of these theories, therefore, according to the TAM, perceived usefulness and perceived ease of use are beliefs that are presumed to influence attitudes towards new technology and mediate the relationship between external variables and attitude.

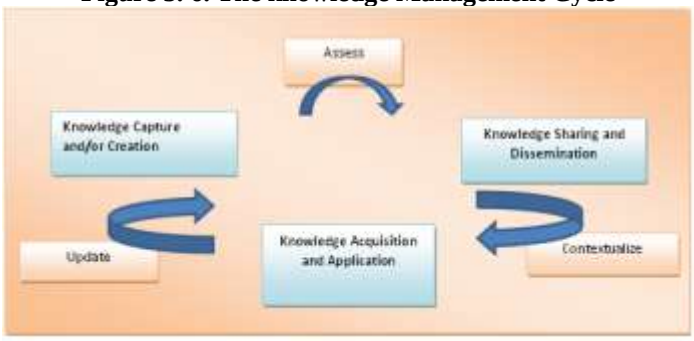
The Community-Based Management Strategy Efficiency

Given the frequency of shocks, poor households rural communities have commonly developed norms and institutions that attempt to reduce risk, which is community-based strategies, Bhattamishra and Barrett (2008:15). Thus, community Based Natural Resources Management is the strategy for the social defined policy aiming to have greater involvement of local communities in the management of natural resources and ensure that they receive benefits from those resources, Nhantumbo, Norfolk and Pereira (2003:10). The irrigation investment projects in Mozambique take into consideration the participation of the beneficiaries as way of considering local knowledge regarding water management at each specific site on premise to go through the preservation of the cultural values that communities attach to the resources that they use. Bhattamishra et. al. (2008:29) state that community-based arrangements for the provision of public goods include community-based construction of physical infrastructure such as irrigation schemes. Thus, community-based irrigation-schemes reduce risk of crop loss or lower yield by providing water in a timely and more regulated manner and can also help with addressing covariate risk such as drought. They typically involve provision of labour by the community and provision of technical knowledge and financial resources externally, through NGOs or the government through public investment.

Knowledge Management (KM)

Dalkir (2005:43) state that knowledge management is the concept under which information is turned into actionable knowledge and made available effortlessly in a usable form to the people who can apply it. Thus, three stages are higelighted, namely, i) knowledge capture and/or creation; ii) knowledge sharing and dissemination and iii) knowledge acquisition and application. Therefore, in the transition from knowledge capture/creation to knowledge sharing and dissemination, knowledge context is assessed. Knowledge is contextualized in order to be understood ("acquisition") and used ("application"), then feedback to update knowledge content. Figure 2.6 show the integrated KM cycle.

Figure 3. 6. The knowledge Management Cycle



In agriculture water infrastructure development, the Knowledge Management Cycle is characterized by the adoption of participatory planning and design of the irrigations technology including the irrigation technology selection to ensure that beneficiaries are well informed about the different alternatives and their preference with certain perceived most suitable alternatives sounding to their local socio-cultural and economic situation of the beneficiary community. This process allows producers acting with well-developed knowledge regarding the advantages and disadvantages of the adopted technology, the reason for its selection as well as the importance of the public investment in the community socio-economic and cultural development. O'Reilly and David (2009:25) state that leadership is identified as a critical success factor for successful project implementation, nevertheless the use of incentives and training is a key factors for combating resistance from associates and managers who will be users of the infrastructure developed through the public investment. Moreover, a common issue in system failures was the lack of recognition for how much effect people could have on system success. Therefore, the positive role of effective leadership and highlighting the need to align people and subcultures becomes relevant for irrigation infrastructure investments successfulness. Moreover, it is understood that without an underlying commitment to customer care, a simple move to irrigation infrastructure technology development will neither result in the desired government goals of enhancing farmer's economic capacity nor the anxieties of the farmers on improving their production level and incomes. Thus rural development strategy primarily aims at improving the use of all existing endogenic resources in the areas considered, ranging from entrepreneurial to environmental and landscape resources to those linked to the cultural and social identity of the individual areas. Specifically, given that the areas involved are prevalently those where the agricultural sector is not able to ensure adequate income levels, the strategy is designed to support and diversify local business systems so as to expand the employment opportunities in sectors linked to agriculture.

Customer value creation management and Customer Relationship Management (CRM) Process Model

Customer Relationship Management (CRM) is a new business philosophy based on trust and value; the core function of CRM is the value creation process, with customer relationships development over time and the basic premise of offering superior value to customers in an effort to turn prospects into customers, customers into loyal customers, and

loyal customers into partners. Development of public irrigation schemes for agriculture production, neither managed by farmers or government or both, impose offering services to beneficiaries, expecting in turn, the full collaboration of farmers and sound operational modes of the developed infrastructure.

According to Payne (2005:11) the value the customer receives from the supplier organization is the total package of benefits derived from the core product and the product surround, or the added values that enhance the basic features such as service and support. The value the customer attributes to these benefits is in proportion to the perceived ability of the offer to solve whatever customer problems prompted the request for the provided goods. For the irrigation infrastructure investment and technology development, it is worth mentioning that Government irrigation agency responsible for projects implementation, build strong customer relationship with the farmers. Such a relationship is benefiting the investment through acting from a customer perspective in a form of providing better public customized service quality and increased control, Chan, Yim, and Lam (2010:51). Therefore, customers' active involvement can help guarantee quality and increase the likelihood of success and goal achievement. Similarly, customers who engage in the service process can reduce the financial and performance risks associated with receiving inappropriate outcomes.

Participation also allows customers to provide direct input into the service provision, make more choices, and works with the service provider to create higher levels of customization and may experience delight when participating because participation leads to a greater sense of control over the service process and the final outcome. As customer participation increases customers' knowledge and control of services, it shifts more power to customers which are particularly crucial for professional services that require a collaborative customer-provider relationship to achieve desirable service outcomes. For example, farmers involved in infrastructure technology selection for investment projects stimulate their perception of infrastructure usefulness and they gain more decision-making power for sustainable infrastructure management, Rababah, Mohd, and Ibrahim (2011:26).

Figure 2. 7. CRM Process Model

Source Rababah, et al. (2011:26)

This model starts with the development of customer strategy in which the target market is identified. This model explains what is needed to be done by the government on its infrastructure development programme, offered to the rural poor people seeking to enhance their capability of production providing great help for organizations to increase the success rate of their CRM programmes/systems.

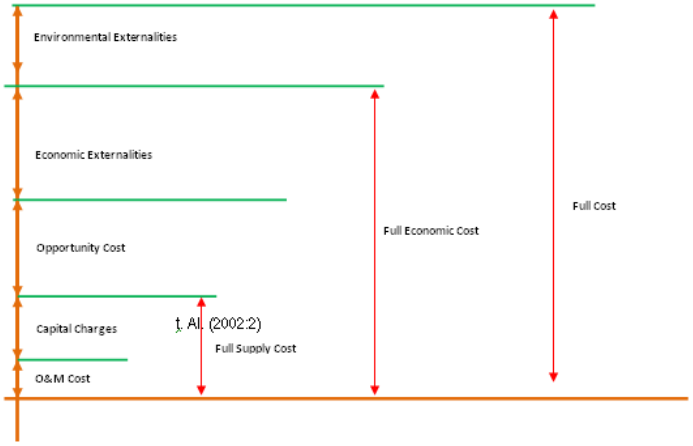
The affordability and willingness of beneficiaries to pay for cost recovery

Following Malik (2008:16), there are three cost concepts for water provision in public water infrastructure. The full supply cost, the full economic cost and the full (social) cost. The compositions of the various components that add up to make the different costs are presented schematically in Figure 4.1. Each of these is explained below in briefly.

According to Bosworth, Cornish, Perry and van Steenbergen (2002:2), and Bosworth, Cornish, Perry and van Steenbergen (2004:4) the full supply cost includes the costs associated with the supply of water to a consumer without consideration of either the externalities imposed upon others or of the alternate uses of the water. Full accounting costs thus are composed of two separate items: O&M costs and capital charges.

In some OECD countries, "full cost recovery" refers to operation and maintenance (O&M) costs only, whereas in others it is the recovery of O&M and capital costs (OECD, 1999). In the European Union, the term incorporates scarcity values and environmental externalities (European Union, 1999, OECD, 1999), which is similar to the Global Water Partnership definition. In the definition of capital costs it is unclear whether this should include the costs of replacing equipment at today's prices or the historic costs of existing equipment.

Figure 3. 8. General principle for the cost of water



According to Jean-Marc Faurès et. al. (2007:377), The "Full Supply Cost" includes the cost associated with the supply of water without consideration of externalities (externalities are the indirect consequences or side effects of supplying water to a particular user or sector). It includes the operation and maintenance of irrigation infrastructure and capital investment. Moreover, "Full Economic Costs" include the full supply costs plus opportunity costs and economic externalities. Opportunity costs acknowledge that by using the water, another user is deprived of it. If the other use has a higher socio-economic value, then there are some costs to society due to 'misallocation' of resources or inefficient use, from a pure, or classical, economic point of view. And "Full Costs" include full economic costs plus economic and environmental externalities. Externalities arise when costs or benefits associated with extraction and use of the resource are imposed on third parties. Externalities, both positive and negative, are an important component in costs related to irrigation water use. Thus cost recovery concerns full supply costs only, costs that can be fairly readily defined, whereas efficient water allocation within a country or basin context requires consideration of opportunity costs and externalities.

Malik (2008:39) states that construction and maintenance of irrigation infrastructure involves huge costs and therefore an important concern for public investments has always been how the costs can be recovered and who should pay. In principle, any cost incurred in providing a service should be recovered from all those who benefit from the provision of these services. Thus, the rationale behind recovering the cost of irrigation infrastructure

and water utilization in whatever way the cost is defined, from the farmers, is that these investments have been made for the benefit of the farmers and the cost of providing irrigation water should therefore be borne by them and recovered from them. Moreover, according to Easter and Liu (2005:22), water pricing and recovery of the costs of irrigation investment, operation, and maintenance have been contentious issues for many decades. The low charges for irrigation water are questioned, as well as, the small percentage of farmers who actually pay the charges. In developing countries such as Mozambique, there are many different reasons for low water fee collection rates including the following:

• No link between fees collected and funds allocated to an irrigation project;
• Lack of farmer participation in project planning and management;
• Poor communication and lack of transparency between farmers and irrigation management;
• Poor water delivery service (timing, duration, or quantity inadequate) and no penalties for managers and irrigation project personnel who provide poor service;
• No user penalties for non-payment of water charges;
• Low priority given to fee collection, efficient water use, and system O&M;
• Small size and very low incomes of irrigated farms;
• Corruption of irrigation officials.

Easter and Liu (2005:5) argue that improving cost recovery clearly involves more than just charging higher fees or spending more on fee collection. The concerns have been specifying, which water provision costs are to be recovered and what mechanisms can be used to recovery them. Thus the full costs of providing irrigation water can be divided into three categories, namely, i) direct project costs; ii) environmental costs; and iii) marginal user costs. Direct project costs are the easiest of the three to measure, and most projects take only direct costs into account in determining cost recovery. Direct costs refer to costs stemming from the process of capturing and delivering irrigation water, which can be broken into fixed costs and variable costs. Fixed costs include all investments in irrigation infrastructure such as building reservoirs and canals and installing meters and pumps, plus depreciation and interest payment on the investment. Nonetheless, higher level administrative costs and some operational and maintenance costs not involved with actual water delivery are also considered fixed costs because they do not vary with the amount of water delivered. Variable costs consists of the operational and maintenance costs of water delivery, lower level administrative costs (usually temporary labour costs during the time of water delivery), and costs of supplying water, which include conveyance costs, groundwater extraction costs, and costs due to water loss. These costs vary with location, water delivery method, irrigation technology, and season. Environmental costs include soil erosion and damage to the surrounding ecosystem during and after the construction of an irrigation project as well as waterlogging and salinity problems caused by the irrigation. However, few irrigation projects in practice include environmental costs as part of their full cost to be recovered. Environmental costs could substantially raise the total costs of many irrigation projects, Easter and Liu (2005:7)

Therefore, to achieve the two primary goals of cost recovery and reduced water use per unit of output in irrigation water management, two key issues must be addressed: first, to design an effective pricing mechanism based on local conditions and, second, to develop a strategy for obtaining high rates of collection, Easter and Liu (2005:8).

According to Bosworth et al. (2002:14) and Easter and Liu (2005:10) there are two categories of charging:

i) Area-Based Pricing: Area-based water charges are fixed charges, based on the area irrigated or "supposed" to be irrigated;

ii) Volumetric Pricing: With volumetric water pricing, the charge is based on the amount of water delivered.

Water policies and strategies in many countries now require the implementation of some form of charging for irrigation services. Most commonly the stated objectives of these policies relate to cost recovery, especially recovery of the on-going costs of operation and maintenance and sometimes the need to conserve water and encourage productive use and optimal allocation, Bosworth et. al. (2004:3). Therefore, clarity of objectives in formulating water charges is essential: some objectives are in direct conflict, high charges to discourage waste will impact heavily on the poorest farmers; sophisticated charging systems based on volumetric measurements are expensive to introduce and operate, resulting in increasing bureaucracy. Other objectives are simply unrelated, the charge required to recovery of O&M is unlikely to be the exact charge necessary to balance supply and demand, thus a clear definition of what charges are designed to achieve is essential. Seeking to cover service costs and fund adequate maintenance, reform of water pricing is most often driven by pressure on government budgets, rising costs of providing services, and government desire to reduce subsidies. For many years, the World Bank has encouraged governments to employ a policy of cost recovery, on the principle that users should cover O&M costs and some of the capital costs in public investment infrastructure, this view, remain valid and applicable for irrigation development projects.

Bosworth et al. (2004:17) argues that, acceptance of the rationale for recovering on-going costs is almost universal even if implementation is not. Full or partial recovery of investment costs is more controversial because irrigation is often seen as development expenditure for backward areas, benefiting not only the poor farmers but also society more generally through lower food prices and food security. Where these costs are not recovered, governments pay the difference, thus subsidizing the agriculture sector, a politically sensitive sector, or the infrastructure deteriorates. The conclusion of most authors is that beneficiaries should pay the full on-going costs of system operation, maintenance, replacement and upgrading of facilities. Such payments should be clearly designated for use by the operating agency, and accounting procedures should be transparent and encourage efficiency in the operating agency. The extent and form of capital cost recovery (for original investments) is a matter for political decision, but again should be open and transparent.

Improve service delivery

Bosworth, et al. (2002:10) emphasizes that irrigation departments in many countries need to improve the operation of the irrigation infrastructure and incentivise their staff members to operate efficiently, thus water charging can accelerate this process. Therefore, the real question for irrigation service financing success is whether the irrigation service provider is willing to redefine its role and function... Rather than an attitude of instruction, managers and field personnel of the irrigation services have to reassess their role, and have to accept water users as counterparts, almost as co-system managers. The logic of pricing for demand management runs as follows: if the primary objective of charging is to recover costs, the issue is

whether the unit price implicit in that objective is the same as that required to match demand and supply in a year of drought as well as a year of plenty. In summary, experiences from real world water infrastructure management, make believing that pricing water to manage demand is unworkable in most situations. However, other authors contend that pricing should go further, nevertheless, getting the fair price to reflect the social value of the infrastructure operation is important. Therefore, it is pointed out that winding down the agriculture sector may not be a viable option for governments where there are no alternative forms of employment for farmers, thus, economic theory cannot override political reality. In this study, financial market forces and social and economic aspects are highlighted for understanding the farmers' willingness to pay for cost recovery and operation and maintenance (O&M) of the developed infrastructure under government public irrigation investments.

The World Bank's Water Resources Sector Strategy (2008) gives strong support for the role of water markets as a means of ensuring that users understand the opportunity cost of water to different sectors. Although the available literature identifies a number of theoretical objectives of irrigation water pricing, in practice just two objectives dominate most of the literature and practice: i) to achieve some level of cost recovery, and ii) to bring about a reduction in irrigation consumption, thus, these two objectives may be combined and addressed through a single approach. Furthermore, while irrigation charging in some form is widely accepted as a means to achieve some level of financial cost recovery, there is debate over the merits of direct charging and other economic tools, such as water markets, to make farmers aware of the opportunity cost of water. Akter (2008:22) argues that theoretically, compensating variation or willingness to pay (WTP) for a programme is known as the amount of payment by a consumer such that the utility after provision of the good or service remains the same as in the base case (without the programme). Willingness to pay is an amount that compensates utility loss due to reduction in income by an improvement in the good or service in question and leaves the household on the same indifference curve.

Objectives of irrigation water charging

Bosworth et al. (2002:15) believe that everyone involved in irrigation and water resource issues claims to recognize that institutional, policy, and political issues are central causes of poor performance. But it has proven difficult to focus governments' and donors' attention on these matters, and develop long-term solutions that can be implemented. Agricultural water pricing plays a significant role in promoting water use efficiency and cost recovery. This study attempts to determine farmers' perception regarding the fairness of prices charged for irrigation water and their willingness to pay in a government managed small scale irrigation project, thus contributing to agricultural water policy reform in order to enhance efficiency and promote sustainability in water infrastructure use developed through public investment. According to Nyoni (1999:446) there is consensus that all users of public water should pay for it although there is variation on what can be deemed a fair price for all. Biggar (2010:433) argues that irrigation infrastructure operators' recover their on-going costs through a set of fees and charges. These charges are typically structured as a two-part or multi-part tariff such as fixed or non-volumetric network access charge and variable charge, which has been in most of cases, a source of conflict and tension between irrigators, irrigation operators and policy-makers.

OEDC (2006:28) states that, for ensuring affordability for the poor people, a demand-led approach can be considered. Thus infrastructure affordability can be significantly improved by taking a demand-led approach, defining appropriate service levels to raise low living standards. Therefore, sector planning must start with a clear understanding of the type, extent and quality of services involved. Many poor households pay large portions of their income for essential infrastructure services, thus, appropriate tariff structures are an important tool for increasing poor people's access. More appropriate tariff collection systems and more flexible service provision for example, in small amounts helps the poor to reduce their spending on such services, which require infrastructure spending allocated appropriately, technically feasible and appropriate, and time-bound, with an exit strategy. Moreover, any tariff increase must be accompanied by visible improvements in service quality, quantity, or both, to increase users' ability and willingness to pay. Water prices charged to irrigators on reclamation projects were originally based on the principle of cost recovery. However, water price was later changed from recovering cost to 'ability to pay' based on the principle of repayment capacity. Price was no longer based on recoverable cost, but on marginal benefits of water used in irrigation. Irrigators were charged prices they could afford to pay unless their repayment capacity was greatly overstated. Beneficiaries paid only a fraction of construction costs. Therefore, irrigation water is often priced below its marginal cost to encourage rural settlement, increase food production, and promote national food self-sufficiency, Ward, (2010:327).

Irrigators may show strong support for irrigation project even when a high contracted price of water charged to them is needed to secure financing for irrigation infrastructure. This support may continue even when the overall economic performance of an irrigation project is weak. If farmers believe they can renegotiate the contract after the system is built and the water is flowing, their support may be greater than would be predicted by calculations of discounted net present value of the project (Ward, 2010:328). Ward (2010:329) believes that lower price of water charged to irrigators' increases farm income and increases the value of infrastructure investments. Lower water prices also increase the economic incentive for farmers to produce high water- consuming crops. Low water prices discourage farmers from growing water saving crops. Finally, lower water prices encourage greater water use and encourage farmers to substitute water for other resources, such as land, labour, capital, and water-conserving technology. Governments rarely assign high priority to using taxpayer resources to maintain irrigation infrastructure already built. A common belief held by governments is that even if it subsidizes the development of irrigation initially, they are less willing to assign adequate budgets to keep infrastructure in top form. Another belief is that since the farmer or other water user is the main beneficiary, they should be able to pay for its upkeep out of the additional income it produces. It is unlikely that the debate will soon be resolved on who should have the responsibility of maintaining infrastructure.

Farmers Willingness to Pay (WTP) vs Water Pricing (WP)

Akter (2008:22) argues that the average water price charged in large scale irrigation water projects has an extremely poor collection rate of 5-15%. A report published by the Water Ministry of Bangladesh (2000) also indicates a very poor water price collection rate (3-10%) and concludes that cost recovery in such intensive infrastructure based irrigation projects is very poor. Therefore, in this study, the extent to which farmers´

willingness to pay for investment cost recovery such as O&M, and including investment cost for infrastructure development was assessed. Akter (2008:22) state that it was found that the maximum willingness to pay was found to be considerably less than the opportunity cost of irrigation water, indicating the unsustainable use of irrigation water at present, furthermore, the WTP have been found to be related to respondents' gender, agricultural income, perceived water sufficiency, education, family size and landholding. Therefore, factors affecting the farmers' willingness to pay for irrigation costs, such as age, gender, family size, number of family members working in agriculture, education, etc. were investigated in this study.

The variable age, as expected, has significant impact on variation in WTP for irrigation water. This finding is highly consistent with the evidences provided by empirical literature. The positive sign of the coefficient of age variable implies, on an average and ceteris paribus, the older the farmer is the higher is the likelihood of accepting an offered bid level for secured supply of irrigation water around the year. This may be because the old farmers have more experience of water scarcity during dry season than younger farmers in the region and therefore, the likelihood of accepting a bid amount varies positively with age. Respondent's education level, has a significant positive impact on the likelihood of accepting and manage complexity irrigation infrastructure. Therefore farmers who have completed at least primary school education exhibited higher likelihood of successful irrigation infrastructure management than illiterate farmers. This result indicates the universal fact that education enhances the awareness in value of scarce public investment in water infrastructure for agriculture production. A positive relationship between family size and likelihood of accepting offered irrigation technologies improvements is expected. The larger the family size, the greater is the food demand. Therefore, secured supply of irrigation water is more important for large households compared to small households.

Other than the household characteristics, the study illustrates some farming characteristics that influence likelihood of accepting the infrastructure management for irrigation water. The ownership of farm land has a positive sign. This implies that farmers who own the land that they cultivate are more likely to accept the infrastructure management and ownership. Furthermore, it is expected that management system of current irrigation supply have a significant impact on farmers' WTP for irrigation water under public investment infrastructure. Farmers who own water pumps are less likely to accept the irrigation schemes management compared to farmers who do not own a water pump. Finally, change in cropping decision after implementation of irrigation infrastructure has a significant impact on variation in stated WTP. Farmers who cultivate a less profitable crop due to shortage of irrigation water and intend to change cropping pattern if irrigation water is available, are more likely to accept the infrastructure management than farmers who already have access to sufficient water supply to grow the crop that they want.

Potential Improvements on Addressing Investments

This study aims at better understanding and producing recommendation regarding potential improvements on addressing investments on water infrastructure for agricultural production. Special attention will be focused on:

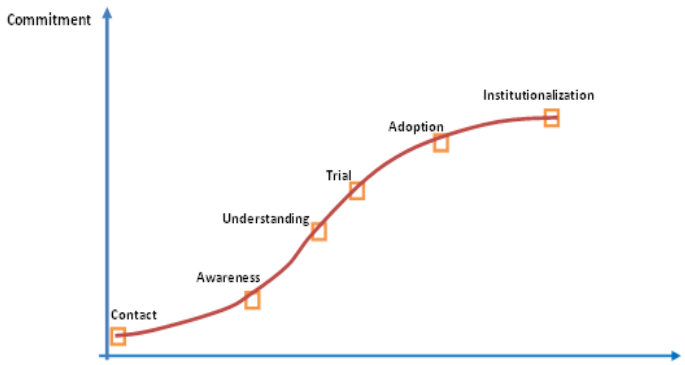
• Broad conditions for national growth and effective public investment strategies;

• Coordination mechanisms across levels of government for public investment, in particular requirements/incentives attached to public investment funds, and their strengths and weaknesses

• Sub-national governance capacities challenges and mechanisms that can help strengthen them for improved public investment strategies;

Where water rights are based on historical beneficial use, irrigators may believe that investments in water conservation measures, such as ditch lining, investing in drip irrigation, or water banking for cash, may cause them to forfeit their conserved water. That is, active steps taken on the farm to conserve part of one's historical water use may be perceived as failure to demonstrate current high water use, even if not needed, is a common method to demonstrate beneficial use in case the water might be needed in the future. Property rights in water have an important effect on the incentive to conserve, as shown in a recent study of Korean agriculture (Ward, 2010:328). One of the reasons for failure in the water sector has been the unwillingness by direct providers to segment customers to a sufficient degree, both within and between countries and then to target levels of services accordingly. This error has been compounded by the presumption that subsidies to all will ensure affordable service to the poor. Dalkir (2005:203) refers to a 6 stages of organisation maturity as shown in figure 2.9.

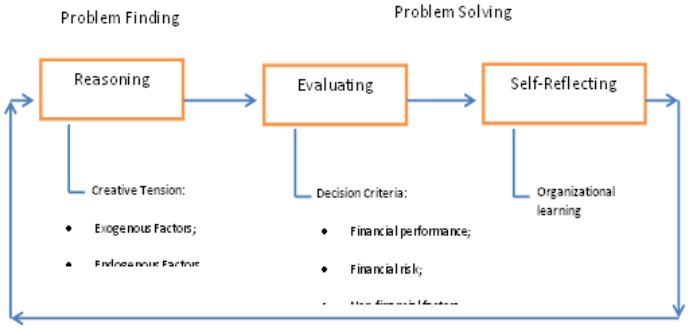
Figure 3. 9. Stages of Organisational Maturity



Source: Dalkir (2005:203)

Indeed, as referred to figure 3.9, investment on water infrastructure for agriculture production, involves decision making and behaviour changes among the beneficiaries. The commitment of the beneficiaries is crucial for the investment sustainability, by adopting and institutionalization of the investment. According to Bayou et. al. (2006.85-86) the important long-term investment decisions requires critical thinking.

Figure 3. 10. The Cyclical Critical-Thinking-Based Investment Decision



Source: Adapted from Bayou and Jeffries, (2006:85)

The word ''critical'' is the key term necessary to understand the concept of critical thinking, which can be explained by a debate in philosophies regarding the nature of critical thinking which involves equation, critical thinking, good reasoning, rationality, in that ''good'' reasoning and rationality need not be critical. The problem-solving stage requires evaluating a set of alternatives, and then self-reflecting upon the completion of the

decision process (Figure 3.10). Once the cycle is completed, experience learned from going through this process enriches organizational learning, and in turn, this helps the reasoning, evaluating and self-reflecting stages, and so on ad infinitum.

Bayou and Jeffries (2006:85) states that the motivation needed for problem finding and solving by describing five stages in arriving at a lasting decision. These stages are: i) appraising the challenge; ii) surveying alternatives; iii) weighing alternatives; iv) deliberating about commitment; and v) adhering despite negative feedback.

Key Findings

Response rate

Saunders et al., (2003:159) state that for postal surveys a response rate of approximately 30% is reasonable and for interviewers you should expect a response rate of approximately 50%. Therefore, in this study, questionnaire module one, for people involved in farming in irrigated land developed with public funds, whose approach used was direct interview, noticed a participation of 262 participants against 281 planned, which represents a degree of participation of 93.24%. On the other hand, the questionnaire module two, especially designed for managers and technicians working in irrigation sector at the Ministry of agriculture, whose administration approach used was postal surveys, 15 senior managers replied to the questionnaire, against 18 questionnaires sent. This represents a rate of response of 83.33%. Both questionnaire modules, according to Saunders et al., (2003:159) have an acceptable rate of response compared to direct interview, and postal survey, therefore, this can be considered satisfactory for survey-based research strategies using a questionnaire as the research instrument. The results of the survey done in the 8 irrigation schemes developed under public investment strategy, shows that the sample population is dominated by people aged over 40 years (73%) and with low educational level (between primary and without school education), which is approximately 68%. About 60% of the surveyed farmers have never had any training in agriculture even of short duration and close to 4% only have some basic technical training. There is almost gender equity in the population working in agriculture, being slightly higher than the number of women which is 55% against 45% of men (Figure 4.1).

Farmers Perception Regarding Public Investments on agriculture water infrastructure

The literature suggests that scaling-up investment in low-income countries is vital; therefore, the link with development outcomes depends critically on the quality and efficiency of public investment. This section will attempt to identify the strength of the public investment management process in the Mozambique´s public investment decision through examining the farmers, managers and technicians perception regarding irrigation public investment. Tables 4.1 and 4.2 shows the farmers answers regarding questions seeking to bring to light, the farmer's perception regarding the importance of public investment in water infrastructure for their business development. The total number of farmers involved in agriculture businesses supported through public investment is about 74%. This confirmed that they have agriculture as their main source of family income, contributing over 75% of total family incomes and only 5% have agriculture as marginal source of income in their family income, contributing less than 25%. The literature (The World Bank's rural strategy, Reaching the Rural Poor), recognizes that water is an essential input into agricultural production, as well as the basis for livelihoods of rural communities. Taylor (2007:13) also confirmed that agriculture water infrastructure is critical to improved productivity and yields. Tapela (2008:182), has mentioned that irrigation farming is widely seen as having a significant potential to enhance rural development, reduce poverty and increase small-scale farmers' productivity, employment and incomes. This recognition was confirmed by this study with about 75% of surveyed farmers disagreeing that yield under rain-fed production is high compared to irrigation infrastructure. Nonetheless, some surveyed producers operating in irrigation developed under public investment (23%), remain with the idea that the production upland under rain-fed system, ensures higher productivity compared with production under water management infrastructure. Moreover, about 36% disagreed that productivity under irrigated systems is far high compared to productivity under rain-fed system. Also it was found that although few farmers (3%) believe and have declared that the irrigation infrastructure built with the aim of boosting the production, it is not an important commodity for their agricultural development. This understanding can negatively affect the overall infrastructure development objectives since it regards the overall perception of usefulness of the developed infrastructure.

Some reasons for them not perceiving the usefulness of the irrigation technology may be associated with various factors including bad technical designing of the developed infrastructure, their organizational level for management of common goods and lack of knowledge to understand management of various complex sectors of irrigation infrastructure. In fact, as referred by Taylor (2007:13) perceived ease of use and usefulness predicts attitude towards use of a technology. Furthermore, Taylor sustains the TAM which states that the success of a system is determined by user acceptance of the system, measured by the perceived usefulness of the system and the perceived ease of use.

Regarding the decision making process for the investments in water infrastructure, about 60% of producers surveyed rejected that they have requested for the infrastructure, while equal number of beneficiaries around 60% of surveyed people said that the investment in infrastructure on their management responsibility, was requested by some informed farmers and was on the government agenda. This way of understanding poses a challenge to the authorities of the agricultural sector to intensify awareness campaigns and approach in decision-making process regarding public investments in order to increase the sense of belonging as well as economic management infrastructure and suitable environmental sustainable management, since it is related to customers participation which according to Chan, Yim, and Lam (2010:50) is an emergent perspective in marketing new opportunities for co-opting customers. This is also a means to define and co-create value through their participation which is highlighted where value is inherent to the use of products/services, such as in a consumer's perceived preferences for and calculation of the benefits. Therefore, investments in agricultural water infrastructure development need to incorporate social and technical capital of beneficiaries and actors on the ground, investing in institutional capacity development at all administrative levels, and in the adoption of a market-led, value-chain based approach. This will impose strengthening the participatory infrastructure development approach, with clear objectives and transitions, triggered by progress against specific indicators for each phase and a comprehensive approach, addressing irrigation intervention holistically, linking infrastructure development with water management and production support, as well as agronomic and

value chain development in a holistic process, looking at livelihoods, and farming systems as a whole.

The survey also shows that about 70% of producers developing their agricultural activities have been working in the areas (under rain-fed production system) even before water infrastructures were developed, therefore, the introduction of an irrigation system represented an innovation on their familiar social, economic and cultural management environments. The government's goal of increasing production rates, taken as priority factors regarding the development and management of water infrastructure becomes a challenge for the farmers' environment which may lead to a sense of identified problem, but there is no sense of priority by beneficiaries themselves. To overcome this situation, investment philosophy in water infrastructure for public use, projects should take into account that being new technology to introduce, as referred by Porter (2006:100) two issues namely, an individual's propensity to use new technology and feel discomfort and security of an individual's propensity to use new technologies and how a technology's attributes affect an individual's perceptions and, ultimately, use of that technology. Indeed, as described in TAM, perceived usefulness and perceived ease are presumed to influence attitudes towards new technology adoption. In fact, irrigation technology provided as water facilities to enhance the production is also an innovation and attempted to be perceived as unsecure to the traditional cropping community based management and discomfort for farmers to accept. To overcome this possible effect, as described by Ahmed (2003:270), referring to the farmers' perception regarding the technologies transferred effect on farmers' returns compared to their traditional practices; farmers need to be informed of the progress of work and maintaining regular and informative communication with them between project through meetings, training programmes, and workshops.

Moreover, insecure information about the participation of farmers in irrigation technology selection decision making process was found in this study. Around 50% of farmers said they were not consulted or briefed before or during the process regarding the irrigation technologies alternatives and decision for selecting one on them. Therefore, about 80% of producers surveyed do not believe that irrigation technology in use was decided by farmers. This situation in not in accordance with what was described on the TAM (Porter, 2006:10) and and also by Dalkir (2005:43) describing the knowledge Management Cycle based on three stages, namely i) knowledge capture and/or creation; ii) knowledge sharing and dissemination and iii) knowledge acquisition and application and engaging to the six Stages of Organizational Maturity as per Dalkir (2005:203) referring to the importance of contact, awareness, understanding, trial, adoption and finally the institutionalization of the new technology. Thus, farmer uncertainty of what is the investment scope will reduce, therefore, according to Herath, (2005:888) uncertainty is an important factor in collective action in irrigation, by developing lack of trust among the participants which in turn, makes difficult to sustain cooperative behaviour. About 84% of the surveyed believe that the infrastructure developed with public funds for irrigation are assets belonging to the beneficiaries of the irrigations schemes, and 88% disagree that the infrastructure is any government asset which is prospect toward technology acceptance, use and perceived usefulness. However, there is about 12% that do not believe so. The high level of perceived ownership of infrastructure may have direct impact on the perception of responsibility for maintenance and payment of all associated costs. Thus as described by O'Reilly & David (2009:25), the use of incentives and training is a key factor for combating resistance from associates and managers who will be users of the infrastructure develop through the public investment. Therefore involving farmers on the decision making regarding infrastructure development raise the farmers' ownership and their willingness to pay for all costs associated.

Importantly, in fact, the surveyed farmers agreed that it is fair and their responsibility to pay for costs associated with the operation of the system and cost recovery, nevertheless, some feel that despite being fair to pay, the amounts charged are high. Of the total surveyed farmers, nearly 90% said that the variable operating costs of the systems are always paid by the beneficiaries. This is supported by Nyoni (1999:446) who believe that there is consensus that all users of public water should pay for it although there is variation on what can be deemed a fair price for all. Easter and Liu (2005:22) who state that water pricing and recovery of the costs of irrigation investment, operation, and maintenance have been contentious issues for many decades through the low charges for irrigation water and the small percentage of farmers who actually pay the charges because of no link between fees collected and funds allocated to an irrigation project; lack of farmer participation in project planning and management.

It was established that poor communication and lack of transparency between farmers and irrigation management remains problematic. Other problems identified includes poor water service delivery (timing, duration, or quantity which is inadequate) and no penalties for managers and irrigation project personnel who provide poor service; no user penalties for non-payment of water charges; low priority given to fee collection, efficient water use, and system O&M; small size and very low incomes of irrigated farms due to market externalities; Ahmed (2003:270). It is recognised that the key factors for public investment success is the farmers perception regarding the technologies transferred and impact on their returns compared to their traditional practices. It was further established that they do not value the technology and do not accept it when they perceive it as not adding value. This reinforces the need for farmers' participation on decisions about irrigation technology alternatives. In fact, this research, found a positive correlation between the farmers perceiving that they have been briefed regarding the technology selection and their agreement that the irrigation infrastructure importance on production enhancement is at significance level of 5%, r=+0,166. It was further established that farmers decided that the suitable irrigation technology for the investment with r=+0.37 and with the agriculture technical training level with r=+0,166 is the most appropriate. This result is in accordance with the fact that the better irrigation technologies do not necessarily mean new, expensive, or sophisticated options, but ones that are appropriate to the agricultural needs and demands, the managerial capacity of system managers and farmers, and the financial and economic capacity needed to ensure proper operation and maintenance. It can thus, be expected that better design and better matching of technologies, management, and appropriate institutional arrangements are essential.

The Farmers Affordability, Willingness to Pay (WTP) for Infrastructure Invested and Cost Recovery

Nyoni (1999:446) stated that there is consensus that all users of public water should pay for it although there is variation on what can be deemed a fair price for all. Nonetheless, Akter (2008:22) argues that the average water price charged in large scale irrigation water projects has an extremely poor collection and found that farmers are willing to pay sums at least equal to

the operation and maintenance cost and are able to pay up to the marginal value product of water. This is in accordance to Biggar (2010:433) who argues that irrigation infrastructure operators need to recover their on-going costs through a set of fees and charges. This study indeed found that above 60% of farmers operating in the irrigation infrastructure agree that it is fair to pay, nevertheless, considerable number of farmers (from 30 to 40%) declared that although it is fair to pay, the fees charges are high. According to Bosworth et al. (2002:21), the ability to pay is not the only factor determining willingness to pay, user confidence in the service delivered and its financial management also plays an important role. Poor service delivery and inadequate maintenance, lead to decreasing willingness to pay all costs associated with cost recovery. Therefore, users in general will be more likely to pay if payment can be linked to an improvement in management and maintenance of the infrastructure.

This section was drawn to determine the farmers' perception regarding their affordability and willingness to pay for running costs and investment cost recovery. It gathers information related to the charges arrangement structure at the irrigation schemes, the farmers' opinions regarding the fairness of the charged taxes for water and infrastructure utilization and the farmers' ability to pay for these fixed fees. The section also analyse the farmers' perception regarding the importance they give to the fixed feed at the irrigation scheme and their contribution on scheme operation and life. It was also examined that the destination of the production if it is neither for family subsistence or business development is also another area that need attention. According to Bosworth, et al. (2002:22) acceptance of the rationale for recovering on-going costs is almost universal even if implementation is not. Full or partial recovery of investment costs is more controversial because irrigation is often seen as development expenditure for backward areas, benefiting not only the poor farmers but also society more generally through lower food prices and food security. Where these costs are not recovered, governments pay the difference, thus subsidizing the agriculture sector, a politically sensitive sector, or the infrastructure deteriorates, in fact the results of the survey has shown that 60% of surveyed acknowledged that it is fair to pay for variable costs and even for infrastructure operation. It is worth mentioning curiously that all interviewed farmers mentioned that there is no related government support since the infrastructure was developed. This can be understood as the government is just taking the development as an infrastructure development only, which according to O'Reilly and David (2009:25) includes leadership, incentives and training that are identified as a critical success factor for successful project implementation in irrigation infrastructure development. Therefore, the positive role of effective leadership and highlighting the need to align people and subcultures becomes relevant for project success. Thus, without an underlying commitment to customer care, a simple move to irrigation technology development will not result in the desired government goals of enhancing farmers' economic capacity and the anxieties of the farmers.

According to Malik (2008), while the primary concern for public investment in irrigation infrastructure is to help farmers adopt technological innovations and increase agricultural production, or to help minimize the impact of erratic weather patterns on agricultural production, this in no way can be regarded as the sole purpose for governments to invest in irrigation. Thus the rationale behind recovering the cost of irrigation water from the farmers is that these investments have been made for the benefit of the farmers and the cost of providing irrigation water should therefore be borne by them and recovered from them. Thus, in this study private investment is necessary for economic progress, and an important but unsettled question is how public policy affects private investment. Developing irrigation infrastructure, will affect the rural communities either on a way they use the technology, either on the required organizational level to ensure sustainability and maximize the utility of the infrastructure on their production. Another important point to note is that about 65% of the surveyed participants said they always manage to pay the amounts set for system operation and its depreciation as this is fundamental for the perception of how they assume are engaged in doing agriculture business. Another aspect verified is that the surveyed producers believe that the payment of fees for system operation and its amortization in addition to being fair create a capacity within the group of beneficiaries to manage the global system in a way. This position was defended by about 92% of the surveyed farmers. In addition to that, 97% of surveyed disbelieved that the payment of fees for operators of infrastructure of water for agriculture, developed with public funds did not matter. Turning to the Nyoni (1999:446) view that there is consensus that all users of public water should pay for it although there is variation on what can be deemed a fair price for all.

Another relevant aspect defended by about 80% of surveyed farmers is that above 75% of their total production is for sale, which emphasized the engagement on taking agriculture as business and infrastructure as bridge for business success. This positioning, and assuming balanced and competitive market conditions (prices), producers have adequate revenue and net profit from their sales that allows them any prosperity in doing this agriculture business, therefore, in fact, the agriculture activity is any profitable business. Being this fact truth, the producers pursue their own capacity to generate income and ability to pay variable costs and amortization of investments in the water infrastructure for agriculture developed with public funds. Another relevant aspect in the operation of irrigation systems is that farmers in all schemes where the survey was conducted have trained a group of producers to ensure the proper functioning of the irrigation system. And as previously mentioned, this group is paid by the producers themselves based on their contributions monthly or seasonally fixed within the system. Nevertheless, it was detected that these group is not their responsibility to run and care for the overall irrigation scheme. The concept of irrigation organization, who deals with the overall operation of the scheme including the calculation of fair costs is not established on the scheme. This situation, results in the fact that the public developed infrastructure are almost abandoned, with no technical operation and maintenance assistance after construction.

Irrigation Senior Managers and Technician Perceptions Regarding the Ministry Pre-decision Mechanism of Public Water Infrastructure Investment

To understand how organizational pre-decision control mechanisms might influence managerial behaviour at the various stages of the strategic investment decision-making process, each of these pre-decision control dimensions were considered in relation to the questions posed in the questionnaire survey.

Managerial perception and the use of formal procedures

Managers in different functional positions may have different perceptions of criteria used to evaluate strategic investment decisions due to their varying goals and interests that

result from functional, hierarchical, professional and personal factors. For example, an engineering company participating in this study had an organizational hierarchy regarding identifying investment opportunities, but each business unit prepared budgets and financial plans in accordance with a defined format, which included the consideration of risks. In general, there are two levels of identifying strategic investments: (1) the individual business, which generally concentrates on the competitive position; and (2) the corporate level, which assesses whether the investment will generate sufficient returns for their shareholders. Managers participating in the survey were asked to indicate their level of agreement with the following two statements:

According to the results regarding the existence of a formal decision to allocate public investment in certain areas, around 70% of managers and technicians surveyed believe that the government has a formal procedure for evaluating investment decisions in public infrastructure. However, it is not inconsiderable the number of managers who do not believe, which is about 30%. Regarding the involvement of the lower level managers and technicians in the investment decision making, 53% were unanimous that these levels are not involved in decision-making processes for the allocation of public investment for agriculture water infrastructure development in Mozambique. The majority of managers (67%) agreed that they had formal procedures for evaluating strategic investment decisions. Regarding the participation of lower level manager, 62% disagreed that lower level managers in the Ministry of Agriculture were involved in strategic investment decisions. In fact the policy framework for the irrigation subsector in Mozambique is given at three levels: i) the supranational level, mainly supported by NEPAD (New Partnership for Africa), ii) Nationally, embodied in Government Programmes, Action Plans for Poverty Reduction and Government Social and Economic Plans, and iii) the sectorial level, primarily by the Agricultural Policy and its Implementation Strategy (PAEI). This picture is completed by a set of sub-sectorial and sectorial policies of that determine the performance of the irrigation subsector, the most notable being between the Law and Politics of Water and Land Law.

The NEPAD-CAADP (Comprehensive Africa Agriculture Development Programme) was prepared by NEPAD and approved in July 2003 by the Assembly of Heads of State and Government of the African Union Summit in Maputo. This initiative defines a set of priorities for the growth of the agricultural sector, rural development and food security in Africa and provides an integrated development based on 5 pillars irrigation is thus called upon to play a key role in the development of agriculture. In year 2000 the Government drafted with support from FAO, a "Irrigation Policy and Implementation Strategy" in order to fill the obvious void on the existing hydro-agriculture policies within the sector of Agriculture. The aim was to thus develop a strategic direction consistent with the programmes of development of irrigated agriculture in Mozambique. Thus it was noted on the survey that these guidance tools/instruments are not full known by all managers and technicians working in the irrigation sector. This will impose challenges to the new created irrigation agency on disseminating the policies and procedures for the public investment in infrastructure development and will enhance the government participation on irrigation scheme management. This according to Lam, (2006:164) will lead to have public irrigation system on a model that is a semi-governmental organization controlled by both farmers and government, and not on the both extremes models (a self-organizing entity controlled solely by farmers or a government department formally established by laws) on public developed water infrastructure, what will indeed ensue a better service quality, customized and increased control as supported by Chan, Yim, & Lam (2010:51) for creating economic value through participation.

The use of financial analyses

An important component of strategic investment analysis is financial evaluation by means of techniques such as net present value (NPV), internal rate of return, payback period and accounting rate of return. To examine the extent to which managers view strategic investment decisions as a matter of financial evaluation, at the Ministry of agriculture for water infrastructure investments, managers and technicians were asked to provide their views on three statements concerning the use of financial evaluation models as following:

• Financial evaluation techniques are often used in the early analysis of strategic investments.

• Financial evaluation techniques are often used in the final choice of strategic investments.

• A strategic investment proposal will be rejected if its expected financial return does not meet the minimum requirements of return on investment.

Interestingly for analysis in this study, is that 47% believe that financial evaluation techniques are often used in the earlier analysis of strategic public investment, and an equal number do not believe so and the remaining are neutral. Then 53% disagree that financial analysis results is crucial for investment while 40% think so. Furthermore, 40% did not believe that strategic investment proposals is rejected if its expected financial return does not meet the minimum request of ROI, notwithstanding about 47% were neutral. The results shows the fact, that if the Ministry of Agriculture has a methodology to evaluate the performance and systematic financial analysis before making any decisions about public investments in irrigation sector, then reigns a communication problem within the institution subsidiaries, since considerable percentage is not informed. On the other hand, the second question that assesses the degree of influence the results of the financial analysis on investment decision making, more that 50% of the participants reported that they are not relevant to the decision of allocation of public investment in irrigation sector. This situation can lead to understand that there are other factors that guide the government's strategy in the allocation of investment beside business factors.

Organisational strategy and operating objectives

While financial evaluation models are perceived as a useful aid at the decision moment, it might be expected that strategic investment decisions are substantially shaped by company strategy. Further, the organizational objectives that flow from strategy constitute a pre-decision control that defines the boundaries and parameters against which strategic capital investment decisions are taken. For example, an organisation concerned with profitability, survival, growth, or technological leadership is likely to favour investment projects that advance those objectives. To examine the extent to which strategic investment projects fit with organisational strategy, managers were asked to indicate their agreement with the following statements.

• Strategic investment decisions derive from an explicit corporate strategy.

• A strategic investment proposal whose expected financial return meets the minimum requirements can be rejected if it does not fit with the firm’s competitive strategy.

These results suggest that many strategic capital projects are shaped by the pre-decision control of a known organisational strategy and that few projects will be accepted if they fail to accord with that strategy. Comments made in follow-up interviews support this strong indication that investment and organisational strategy are perceived as strongly linked. Although the government actually has legal instruments that guide the strategic decisions of investment in irrigation sector, a considerable number (47%) of senior managers and technicians were neutral to confirm the use of these instruments, while, 40% believe that strategic investment decisions derive from an explicit corporate MINAG strategy. Regarding a strategic investment proposal and expected financial return, 47% accepted that a strategic investment proposal whose expected financial return meets the minimum requirements can be rejected if it does not fit with the MINAG competitive strategy. There is a strategy for the Ministry of Agriculture that guides the sort of project the irrigation department looks at. Therefore, the irrigation sector in Mozambique have a fairly clear view about the sort of projects that looks at and that fit with the Ministry and Government strategy, and if it falls outside these sorts of projects, then the public investment for water infrastructure would not go ahead with it.

These results can also confirm the understanding that there is a long-term business strategy and there is an annual plan which is obviously consistent with Ministry strategy. Therefore, there is a Government strategy that is revisited every year by the board, and there is an annual plan approved by the board, which is consistent with strategy. All investments really must be aligned with that strategy. The formulation of strategic goals and priorities can, therefore, be seen as an influential pre-decision control in the strategic investment process, having a significant impact on investment choices before projects are even evaluated and often superseding the importance of financial analysis outcomes. However, recognizing the low certainty despite positive participants responded, suggest that these government instruments are not sufficiently disclosed and not part of the operational plans of many technicians, which imposes an urgent need for leaders to ensure the flow of the plan organizational strategy to increase the individual contribution of all stakeholders.

Key organizational objectives that shape capital investment

To identify the key organisational objectives that shape capital investment decisions, respondents were asked to indicate the recent (i.e. over the past five years) importance of various indicators of a capital project's contribution to their company's success. Suggested indicators included: profitability (net profit), efficiency (low costs), growth (increase in total assets/sales), shareholder wealth (dividends plus share price appreciation), and utilization of resources (e.g. ROI), and economic value added, market leadership (market share), technological leadership (innovation, creativity) and survival (avoiding bankruptcy). Regarding manager's perception of key indicators of capital projects' contribution to organisational objective success, the results show that profitability (net profit), efficiency (low costs) and shareholder wealth (dividends plus share price appreciation) are the key contributions to organizational success that managers look for in strategic investment projects. These results are not surprising, because short-term profit has previously been found to be a crucial factor shaping investment decision making in the Ministry of Agriculture. An interviewee confirmed the pre-decision control role of these organizational objectives in shaping the public investment choices. Investment proposals on irrigation infrastructure has to focus on the market and why they believe that market to be attractive and how it is adding value to the customer's business. They have to focus on cost saving. All these criteria must be taken into account and included within the capital expenditure proposals. But the ultimate focus is on making sure that the investment can get the financial return on the investment. At the end of the day, to keep the agriculture as a business, the financial return is the consequence of all the business decision that is made. The strong emphasis on financial objectives (e.g. profitability, cost efficiency and shareholder wealth maximization) may reflect the fact that managers' performance is often evaluated on the basis of short-term accounting criteria, which may not be completely aligned with the long-term goals and strategies of the Ministry. It appears, therefore, that organizational strategy and performance objectives act as strong pre-decision controls to shape decision-makers' perceptions of strategic investment projects.

Approval authorities and managerial intuition

Following their evaluation and consideration at various levels in the organisation, strategic investment projects usually progress up the organisational hierarchy until finally approved or rejected. To examine the influence of the most senior managers over capital investment resources and decision-making processes, managers were asked to indicate their level of agreement with the following statements:

• Strategic investment decisions emerge through the formal planning processes of our firm.

• The evaluation of strategic investments is left to the judgment of top management.

• A strategic investment proposal whose expected financial return meets the minimum requirements of return on investment can be rejected if it does not satisfy the expectations and intuition of the top managers.

This study found that strategic investment decisions emerge through the formal planning processes of MINAG and that the evaluation of strategic investments is left to the judgment of top management, thus, it is not surprising that such investment decisions are usually authorized by senior executives at the top level of the organisation's hierarchy since strategic investment decisions require a solid understanding of the organisation's objectives, as well as an understanding of the environment in which the organisation operates. The use of decision authority is a major aspect of how pre-decision control mechanisms influence managers' behaviour. Where strict authorization controls exist over resources, these formal systems for authorising capital expenditure restrict the independence of divisional managers. The ultimate authority for strategic investment projects rests with top management, with only a limited amount of this authority delegated to lower level managers according to pre-determined spending limits assigned to different hierarchical levels.

Correlation analysis of different indicators

In this study, we performed a correlation analysis between the different variables that allow analyzing the research questions and answers. Correlations were used to indicate a predictive relationship that can be exploited in practice.

Correlation Analysis Interpretation

The analysis conducted for this study, was considered a confidence interval of 5% (=0.05). Thus, there is a correlation between the parameters. Contrary to general understanding regarding young farmers as referred by Akter (2006:25) the older age reflects a greater responsibility in the adoption of technologies and their implementation, because the old farmers have more experience of water scarcity during dry season than

younger farmers in the region and therefore, the likelihood of accepting an new irrigation technology introduced to improve their farming varies positively with age, based on the fact that they pursue best local knowledge about the value of water scarcity, this study showed that older age is correlated with low educational level ($r \geq -0.383^{**}$; $\alpha=0.05$) and on the other hand tend to be dominated by women ($r \geq -0.236^{**}$; $\alpha=0.05$). However, this group has its base and source of economic survival in farming ($r \geq +0{,}316^{**}$; $\alpha=0.05$). This imposes the need to promote human resource development in various aspects and dimensions for sustainable management of irrigation schemes, promoting the participation of water users in the planning and design process of the water infrastructure, and strengthening them to take up their roles and responsibilities as new or enhanced Irrigation Organisations and also help establishments of the Producer Associations and support their participation in scheme development seeking for widening farmers' responsibilities and authority over water management.

The producers with some training in agriculture or agricultural cost, tends to believe that the producers had active participation in technology selection ($r \geq +0.166^{**}$, $\alpha=0.05$), which in turn has a positive correlation with the recognition of the importance of infrastructure irrigation structure ($r \geq +0.166^{**}$; $\alpha=0.05$). This situation supports the need for promotion of the farmers' capacity development, including the whole stakeholders. The correlation results indicate that the type of producers who are operating in irrigation systems, are predominantly agricultural producers based livelihoods and with low education levels or illiterate. Therefore, the challenge posed is to turn them into farmers which are having agriculture as a profitable business with increased income rates. However, here is a challenge due to the low level of education, since according to Akter (2008:24) education level' has a significant positive impact on the likelihood of accepting and manage complexity irrigation infrastructure. Hence education enhances the awareness in value of scare public investment in water infrastructure for agriculture production. Notwithstanding, the literature, citing Akter (2008:24) was expected that the older the farmer age, the higher is the likelihood of accepting an offered bid level for secured supply of irrigation water round the year, because the older the farmers, have more experience of water scarcity during dry season than younger farmers and therefore, the likelihood of accepting a bid amount varies positively with age. This was not proved on this study. Adversely, the higher is the farmers' age, the lower is the education level and higher the resistance of understating the importance of irrigation importance and the need for increasing production to scale the marked demand.

With regards to analysis we considered for the parameter with a positive correlation it is noted that although some farmers believe that productivity under rain-fed production system is high than in irrigation system, positive correlation was found within this parameter compared to the parameter of how producers were engaged on the scheme. Those who were historically exploiting the area under rain-fed production, they believe that irrigation production provide high productivity compared to rain-fed system tested at 5% significance interval ($\alpha=5\%$) with R=0.1999. while these that have started their agriculture activity after the infrastructure tend not make them any less real, valuable or important of the infrastructure. It was also observed that a significant positive correlation between famers selected under local competition and the beliefs that production under rain-fed provides better results (R=0.2000). This prove that locally farmers lack knowledge of the irrigation system management and importance to production rising. This can be associated with the lower academic and agriculture qualification verified on the surveyed farmers. This is supported by the positive correlation between farmers' agriculture qualification and their belief that they were briefed during technology selection. In fact, the literature reveals that there is a significant positive impact on the likelihood of accepting and managing complex irrigation infrastructure by farmers who have completed at least primary school education than illiterate farmers. This result indicates the universal fact that education enhances the awareness in value of scarce public investment in water infrastructure for agriculture production.

Another relevant positive correlation which is within the parameter is an indication that farmers were briefed during the irrigation technology selection (FWB) and these referring to the value they give to the water infrastructure and their engagement with the investment beneficiaries. From this correlation, it can be derived that the more the farmers believe that they were briefed during the technology decision making process, the greater are the chances that they value the developed irrigation infrastructure and most of these farmers were not having historical exploitation of the area, which mean that they started their activity with the establishment of the water infrastructure through public investment. Therefore, these farmers who believed that they we briefed, tend to accept that the technology chosen was thus, done by farmers. This will enhance the farmers' perception that the technologies transferred are of high significance to returns compared to their traditional practices thus valuing and accepting it. In fact, the literature, Chan, Yim, and Lam (2010:51) were expecting that customers' active involvement can help guarantee quality and increase the likelihood of success and goal achievement and this participation also allows customers to provide direct input into the service provision, make more choices, and work with the service provider to create higher levels of customization that may lead to farmers' delight with the final outcome.

The negative correlation was observed between farmers within the parameters referring to the fact that farmers that decided to participate in the selection of irrigation technology and those that were briefed and those that claimed for the investment did not respond accordingly. In fact as soon as they see the irrigation decision making process as an issue of technicians, thus they refuse to continue with their involvement. This correlation, sustain the findings from the frequency analysis which indicate that some beneficiaries has no ownership insight of the developed infrastructure. This call for government attention to strengthening the awareness campaigns of proposed sites for investment regarding the government objectives on developing the water infrastructures for agriculture. Believing that farmers requested for the investment which means the irrigation investment on the site is following the demand-driven approach, and that famers decided for the installed irrigation technology infrastructure, rise the famers consents that it is fair to pay for infrastructure utilization to cover variable and amortization costs which impact directly on their willingness to pay (WTP). It was also found that the farmers' ability to pay for fees fixed at the irrigation system is positively correlated to the belief that irrigation system is an important assertion to enhance production and the infrastructure developed on the site. It was further established that any farmers' request and perception of fairness to pay for the operation of that scheme remains relative. In fact, the literature asserts that some authors believe that in some ways, farmland is

even better than gold or silver and constitute an intrinsically useful tool for providing a tangible yield in the form of food thus, irrigation remains a key input for raising productivity across a broad range of land.

Broad positive correlation was also verified between the parameter indicating that paying for water and infrastructure utilization create local capacity and these indicating that it is fair to pay (FTP), and the producers were always able to pay (ABAP). This understanding boosts the farmers' ownership and insight to participate on the community-based management strategy development for the public-developed water infrastructure sustainable management. On the other side, negative correlation were observed within ABAP and TD, which means that the more farmers believe that they are always able to pay for charges fixed for irrigation schemes, less they believe that the irrigation technology was only chosen by technicians (TD). The parameters PIFHRS is negatively correlated with PRHTIS and positive correlation with HEA, FD and TD. The negative correlation is obviously a test of the model, which physically means that two bodies cannot occupy the same space at the same time. Believing that productivity under irrigation system, obviously disagree that production under rain-fed is high compared to the irrigation management. The positive correlation between PIFHRS and HEA, FD and TD, shows that farmers' perception that irrigation commodities enhance production is likely perceived by those who historical were exploiting the area under rain-fed production and those, they believe were briefed and participated in decisions regarding the installed technology before being established. Those farmers perceiving irrigation as enhancing the production also tend to reveal that technician designed the scheme.

Farmers, senior irrigation managers and technicians perception regarding the public investment on water infrastructure investment

The importance of irrigation water in increasing agricultural production and in raising the incomes of beneficiaries is well recognized. Most of the world's irrigation systems have been built and operated by government agencies. Almost everywhere, irrigation systems supply irrigation water at highly subsidized prices in the sense that water users are charged only a fraction of the cost of supplying water to them. Irrigation remains a key input for raising productivity across a broad range of lands. The sustainability of infrastructure investment in agriculture sector is dependent on the local farmers' management. Therefore; the irrigation investment projects should take into consideration the participation of the beneficiaries as a way of considering local knowledge regarding water management at each specific site on the premise to go through the preservation of the cultural values that communities attach to the public funded infrastructure operation. The variable 'AGE', as expected, has significant impact on variation in WTP for irrigation water. This finding is highly consistent with the evidence provided by empirical literature. The positive sign of the coefficient of AGE variable implies, on an average and ceteris paribus, the older the farmer is the higher is the likelihood of accepting an offered bid level for secured supply of irrigation water throughout the year. This may be because the old farmers have more experience of water scarcity during dry season than younger farmers in the region and therefore, the likelihood of accepting a bid amount varies positively with age.

'Respondent's education level' has a significant positive impact on the likelihood of accepting and managing complex irrigation infrastructure. Therefore farmers who have completed at least primary school education exhibited higher likelihood of successful irrigation infrastructure management than illiterate farmers. This result indicates the universal fact that education enhances the awareness in value of scare public investment in water infrastructure for agriculture production. Other than the household characteristics, the study illustrates some farming characteristics that influence likelihood of accepting the infrastructure management for irrigation water. The ownership of farm land has a positive sign. This implies that farmers who own the land that they cultivate (these who historically were exploiting the area before the infrastructure was developed) are more likely to accept the infrastructure management and ownership. Furthermore, it is noted that the management system of current irrigation supply have a significant impact on farmers' WTP for irrigation water under public investment infrastructure. Farmers whose irrigation system does not provide enough discharge for the irrigation schedule, are less likely to accept the irrigation schemes management compared to farmers whose irrigation scheme provide suffice water for crop requirement.

Strategic investment decision making draws on expertise from a range of personnel including engineers, managers throughout the organizational hierarchy, and the board of directors. Although many prior studies have examined the impact of financial evaluation techniques on the investment choices made by these organizational actors, how investment decisions take shape depends also on the decision objectives, strategies and procedures employed to guide choices and to harmonise different views. This study has drawn on a combination of survey results and semi-structured interviews to explore managers' perceptions of how these pre-decision controls influence strategic investment decisions. The use of follow-up interviews added depth to the survey results by probing exactly how and why managers perceive pre-decision controls to influence their decision-making behaviour. The findings reveal that pre-decision controls, in a variety of forms, have a significant impact on how organizational actors view and evaluate strategic infrastructure investment projects. The capital budget and capital expenditure limits at different hierarchical levels emerge as among those traditional accounting-based control systems most frequently used to guide the investment decision process. Formal project appraisal procedures, standard formats for investment proposals, hurdle rates, and pre-set authorization levels are also major pre-decision control mechanisms that influence managerial behaviour at an early stage in the investment process.

Indeed, the significant influence of such pre-decision controls suggests that strategic investment decisions are partially shaped even before they enter the formal evaluation stage, and rely only in part on the outcomes of formal financial analysis. In order to understand the factors that shape strategic investment decisions and align them to organizational strategy, more attention is required to the choice and design of pre-decision controls and to the important role of strategic management accounting tools over the more traditional financial analysis techniques that have formed the focus of much prior empirical research.

The Farmers Affordability and Willingness to Pay (WTP) for Infrastructure Investment and Cost Recovery

The more the farmers are briefed before the establishment of the public infrastructure, the more they perceive it as fair to pay for water infrastructure operation and amortization, and therefore, the more they perceive the need for participating on the community-based management strategy for infrastructure operation and maintenance. The most common aspects reported to affect farmers' willingness to pay for infrastructure operations

and cost recovery are associated with, is no link between fees collected and funds allocated to an irrigation project; lack of farmer participation in project planning and management; poor communication and lack of transparency between farmers and irrigation management; poor water service delivery (timing, duration, or quantity inadequate) and no penalties for managers and irrigation project personnel who provide poor service; no user penalties for non-payment of water charges; small size and very low incomes of irrigated farms affected by externalities. For ensuring affordability for the poor people, a demand-led approach can be considered. Thus infrastructure affordability can be significantly improved by taking a demand-led approach, defining appropriate service levels to raise low living standards.

Any tariff increase must be accompanied by visible improvements in service quality, quantity, or both, to increase users' ability and willingness to pay. Recovery of O&M costs should generally not prove onerous to farmers, nevertheless, farmers' dissatisfaction with levels of service and weak procedures for assessment, billing and enforcement commonly result in low levels of fee recovery. The principal constraint therefore appears to be in the management of systems and the administration of charging procedures in practice, rather than farmers' ability to pay. It is important to note that the better irrigation technologies do not necessarily mean new, expensive, or sophisticated options, but ones that are appropriate to the agricultural needs and demands, the managerial capacity of system managers and farmers, and the financial and economic capacity needed to ensure proper operation and maintenance, thus, can be expected better design and better matching of technologies, management, and institutional arrangements. The ability to pay is not the only factor determining willingness to pay, user confidence in the service delivered and its financial management also plays an important role. Poor service delivery and inadequate maintenance, lead to decreasing willingness to pay all cost associated to cost recovery. Therefore, users in general will be more likely to pay if payment can be linked to an improvement in management and maintenance of the infrastructure.

Better governance can optimize investment needs, promote more efficient use of existing resources, enhance the ability of the water sector to attract finance, and harness the efforts of all stakeholders, including the private sector; this requires, amongst other things, improved regulatory oversight, incentives, and accountability of water operators, whether public or private. Most irrigation schemes face a gap between the levels and quality of water services they would like to provide and what they think they can afford. Closing this gap requires good stakeholders' participation on the investments phases and appropriate communication strategy to enhance their perception of ownership and increase their willingness to pay for investment cost recovery. On the demand side, better governance of the sector can help optimize the amount of investment required. For example, incentives for better management of water services provision can reduce water consumption and boost the operational efficiency of water operators. This can be achieved by reducing leakage and energy use, increasing bill collection rates, choosing appropriate technologies, and encouraging better investment planning. Such measures can reduce investment needs and increase internally generated revenues to finance investment. Investment in agricultural water infrastructure must address poverty reduction by focusing on the adoption of efficient water management practices and technologies suitable for smallholders.

The Government interventions to improve the sustainability of the public investment in irrigation sector in Mozambique

The government must consider a formal procedure of investment decision making process and disseminated to all managers and technician working at irrigation sector. The government policy on public investment in water for agriculture infrastructure need to be widely transmitted to the farmers through several meeting to create famers' insight of ownership of the public investment, the need for their contribution on operation expenditures and amortization of infrastructure, taking into account that the investment are unrepeated decision making. Beneficiary support must be demand-driven and commitment-based, with a pledge to participate in all phases of irrigation site development, and operate and maintain the irrigation assets in a sustainable manner. Farmers' involvement policies enhance their insight perception of infrastructure easiness of use and perceived usefulness of the developed technology. Thus, the success of use of irrigation development, are dependent upon perception of the beneficiaries of how easy and costly is the O&M of the system and what values are added by water facility in production and farmers' income. The need for use of incentives and training is key factor for combating resistance from associates and managers who will be users of the infrastructure developed through the public investment.

Government should ensure improvements and enabling environment, strengthen institutions, and enhance beneficiaries' capacity for a sustainable development and management of irrigated agriculture. In fact, engineering designs sometimes do not match the management capacities of agency staff, water user associations or farmers. Even simply structured irrigation systems with proportional division of flows through branching networks of canals require well trained professional managers and operators to achieve acceptable levels of performance in water delivery service. The government need to include on the investment projects the promotion of the participation of water users in the design of irrigation schemes, and strengthen these to take up their roles and responsibilities as new or enhanced Irrigation Organizations. The project will also help establish Producer Associations and support their participation in scheme development. To achieve the two primary goals of cost recovery and reduced water use per unit of output in irrigation water management, two key issues must be addressed, namely, the design of an effective pricing mechanism based on local conditions and, second, to develop a strategy for obtaining high rates of collection.

A key insight from this study is that the achievement of integration between the firm's strategic investment projects and the overall organisational strategy forms a critical pre-decision control on managerial behaviour at an early stage in the investment process, since organisational strategy is usually set in advance of capital projects being considered. The necessary relevant information for strategic investment decisions cannot usually be captured by financial evaluation only. Rather, sound strategic decision making requires the support of a large amount of varied information, a significant proportion of which is collected and analysed prior to potential investment projects being considered, such as information related to strategic goal setting, risk adjusted hurdle rates and the design of appropriate organisational decision hierarchies. The next section summarises the primary and secondary findings to address the research questions and makes recommendations.

Conclusions and Recommendations

This section presents the main conclusions of this study. More specifically, the conclusions are drawn for each research

question and research specific objective. Secondly, the relevant and feasible recommendations are drawn for the Government of Mozambique through the Ministry of Agriculture to address the strategic investment in water infrastructure. Finally, recommendations for further research are advanced.

Irrigation has large positive impact on poverty reduction and livelihoods improvements in both rural and urban areas providing cheaper food for everyone and employment opportunities for the landless poor (Svendsen, 2007:364). Nonetheless, typically irrigation water users are charged only a fraction of the cost of supplying water to them. In many cases, these charges fail to even cover operation and maintenance (O&M) costs, and they almost never cover any of the substantial capital costs incurred in developing water collection and distribution systems (Malik 2008:7). This study revealed that all producers surveyed, have agriculture as their main source of household income and the entire production is focusing on the agricultural business. However, the fixed costs for operating the irrigation infrastructure are perceived fair by producers even though recognizing that the amounts charged are high.

For several years the World Bank has encouraged governments to employ a policy of cost recovery in the belief that users should pay fees to cover O&M costs and some of the capital costs (Bosworth, 2004:22). In fact, this study found that all irrigation infrastructure developed through public investment, pursue mechanism cost recovery collection, for O&M and amortization of infrastructure, nonetheless improvement on its implementations are needed for offering security and best services to these farmers who pays for the services. The producers' perceptions for paying the cost recovery is positive and they believe this enhances farmers capacity for managing the irrigation infrastructure, nonetheless, they are not fully committed with the formula these value are derived. Cost recovery requires a politically sensitive choice as to the extent of cost recovery, full recovery of capital and O&M costs at realistic interest rates, or partial recovery, implying some level of explicit or hidden subsidy. For either economic or political reasons, the full cost of providing irrigation is never recovered. Where capital costs and O&M costs are not recovered, governments pay the difference, thus subsidizing the agricultural sector, which is a politically sensitive area (Bosworth, 2004:22). Malik (2008:39) concluded that any cost incurred in providing a service should be recovered from all those who benefit from the provision of these services. Therefore the rationale behind recovering the cost of irrigation infrastructure and water utilization in whatever way the cost is defined, from the farmers, is that these investments have been made for the benefit of the farmers and the cost of providing irrigation water should therefore be borne by them and recovered from them. In the surveyed irrigation infrastructure, it was found that all cost related to infrastructure operation are on beneficiaries/ farmers charge and no government support since the infrastructure was developed.

In practice, most countries seek only to recover annual O&M costs and possibly some fraction of capital investment costs (Malik, 2008:9). In fact this study has showed that the high number of farmers, were always able to pay for the irrigation infrastructure utilization. Therefore recovery of O&M costs is generally not proved onerous to farmers nevertheless, farmers' dissatisfaction with levels of service quality provided on the schemes and weak procedures for assessment, result in low levels of farmers willingness to pay for cost recovery being the principal constraint management of the systems and the administration of charging procedures in practice.

The main conclusions of this study include the relevant aspects flowing from the data analysis, observations and analysis of Key Informants information. The importance of irrigation water in increasing agricultural production and in raising the rural people's incomes is well recognized by the farmers operating in the public investment developed water infrastructure for agriculture. Thus, irrigation remains a key input for raising productivity across a broad range of lands. The Government of Mozambique, through the Ministry of agriculture, has a strategic investment pre-decision mechanism and procedures, nevertheless, the mechanism are not fully disseminated on domains of all irrigation senior managers and technicians. The Government service delivery for water infrastructure development by the Ministry of Agriculture is widely perceived with moderate quality. Farmers are normally briefed on engineering irrigation planning and designing but they are not engaged on further training or technical assistance to ensure adequate irrigation infrastructure management. Farmers' involvement and participation in investment phases enhance the knowledge creation and dissemination, technology acceptance fine-tuning the local community based management for infrastructure management ensuring its sustainability and profitability operation.

Contrary to young age cohorts as referred by Akter (2006:25) the older age reflects a greater responsibility in the adoption of technologies and their implementation, because the old farmers have more experience of water scarcity during dry season than younger farmers in the region and therefore, the likelihood of accepting an new irrigation technology introduced to improve their farming varies positively with age, based on the fact that they pursue best local knowledge about the value of water scarcity, this study showed that older age is correlated with low educational level ($r \geq -0.383^{**}$; $\alpha=0.05$) and on the other hand tend to be dominated by women ($r \geq -0.236^{**}$; $\alpha=0.05$). However, this group has its base and source of economic survival in farming ($r \geq +0{,}316^{**}$; $\alpha=0.05$). This can jeopardise the impact of the investment as their prospect regarding agriculture development are very limited although recognizing the importance and usefulness of irrigation infrastructure. Therefore, apart from age, experience and business knowledge on the farmers can be the key for the success of the investments. Thus, this imposes the need to promote human resource development in various aspects and dimensions for sustainable management of irrigation schemes, promoting the participation of water users in the planning and design process of the water infrastructure, and strengthening them to take up their roles and responsibilities as new or enhanced Irrigation Organizations and also help establishments of the Producer Associations and support their participation in scheme development seeking for widening farmers' responsibilities and authority over water management.

It was noticed that farmers who own the land that they cultivate (these who historically were exploiting the area before the infrastructure was developed) and having participated on the irrigation scheme planning and development are more likely to be linked with their responsibility of keeping operating and maintaining the infrastructure than those who entered after the infrastructure were developed. Poor service delivery neither by the Ministry of Agricultural technical assistance nor by the technical operation of the irrigation infrastructure associated to engineering design, with reduced discharge to feed the crop water requirement and irrigation schedule, negatively impact on the farmers' WTP for irrigation water under public investment

infrastructure. The achievement of integration between the firm's strategic investment projects and the overall organizational strategy forms a critical pre-decision control on managerial behaviour at an early stage in the investment process. The significant influence of pre-decision controls suggests that strategic investment decisions are partially shaped even before they enter the formal evaluation stage, and rely only in part on the outcomes of formal financial analysis. A transparent process, where farmers help to decide which components should be included in the costs to be recovered from them through water charges, is an important stepping stone toward increasing their authority. As part of this process, farmers need to be consulted early about the design and level of service they want, as well as the extent and type of any improvements in the system infrastructure, allowing them to participate in decision making which improves their willingness to pay water charges.

The more the farmers are briefed before the establishment of the public infrastructure, the more they perceive it as fair to pay for water infrastructure operation and amortization, and therefore, the more they perceive the need of participating on the community based management strategy for infrastructure operation and maintenance. Lack of/ weak links between fees collected and the funds allocated to public investment in irrigation infrastructure which is denoted by focusing the public investment on single infrastructure development with lack of management training for the scheme operation; the lack of/ weak farmer participation in project planning and management; poor communication and lack of transparency between farmers and irrigation management; poor water service delivery (timing, duration, or quantity inadequate) and no penalties for managers and irrigation project personnel who provide poor service; no user penalties for non-payment of water charges; small size and very low incomes of irrigated farms affected by externalities was found as the major factors affecting farmers willingness to pay for cost recovery in the studied public investments on water infrastructure in this research.

The farmers' affordability and willingness to pay for cost-recovery was found moderate satisfactory. Nevertheless, a demand-led approach combining the local-based knowledge creation and management is required with well-defined appropriate service delivery level to raise low living standards where any tariff in the irrigation scheme must be accompanied by visible improvements in service quality, quantity and or both.It was found that recovery of O&M costs is generally not proved onerous to farmers, nevertheless, farmers' dissatisfaction with levels of service quality provided on the schemes and weak procedures for assessment, result in low levels of farmers willingness to pay for cost recovery being the principal constraints to management of the systems and the administration of tariff procedures in practice. Low returns to public investment arise from poor selection and implementation of projects due to limited information, waste and leakage of resources, and weak technical expertise. Engineering designs sometimes do not match the management capacities of agency staff, water user associations or farmers. Even simply structured irrigation systems with proportional division of flows through branching networks of canals require well trained professional managers and operators to achieve acceptable levels of performance in water delivery service.

The better irrigation technologies do not necessarily mean new, expensive, or sophisticated options, but ones that are appropriate to the agricultural needs and demands, the managerial capacity of system managers and farmers, and the financial and economic capacity needed to ensure proper operation and maintenance, thus, can be expected better design and better matching of technologies, management, and institutional arrangements. To obtain high cost-recovery rates, farmers should not only agree on the costs to be recovered but also see that the fees collected are used to maintain and improve "their" system. One good approach is to have the water supply entity or the Water User Associations (WUA) collect and keep most of the fees for use in "their" system. This is one of the big benefits of having a financially autonomous water supply entity. This is one of the big challenges ahead of the newly formed Irrigation National Institute (INIR) under the Ministry of Agriculture (MINAG).

Government-society synergy is instrumental to materializing development potentials in various domains of collective action, therefore, a synergy between farmers and irrigation managers can help bring about good irrigation performance. The government's formal procedure regarding the public investment decision making process in water infrastructure development is not widely known even within the personnel working within the institution. While government policy on public investment in water infrastructure for agriculture need to be widely spread to farmers and managers through several meeting to create farmers' insight of ownership of the public investment, including their operation and management. On the other side there is a need to adopt any clear linkages between policy objectives and tariff methods in the irrigation infrastructure developed through public investment. Investment in water infrastructures for agriculture development must be beneficiary demand-driven and commitment-based, with a pledge to participate in all phases of irrigation site planning and development, and O&M of the irrigation assets in an economic and environmental sustainable manner. Farmers' involvement policies of technology development, knowledge creation and dissemination and community based management stimulation, incentive and trainings, are key factors for public investment success through the Ministry of Agriculture.

Establishing an active WUA is definitely an effective way of involving farmers in the decision making process and improving service quality. The government needs to include on the public investment projects the promotion of the participation of water users in the planning and design process of the water infrastructure, and strengthening them to take up their roles and responsibilities as new or enhanced Irrigation Organizations and also help establishments of the Producer Associations and support their participation in scheme development. As part of widening farmers' responsibilities and authority over water management, the government should provide them with training and technical assistance. The Government investment projects should deem on the infrastructure design an effective pricing mechanism based on local market conditions for production factors and product selling, including the irrigation technology selected and, develop a strategy for obtaining high rates of fees collection as it was seen from this study that there is no pricing mechanism between the farmers and the consumer markets. The Government interventions to improve the sustainability of the public investment in irrigation sector in Mozambique should also consider two key approaches, namely, the establishments of autonomous water supply entity (WSE) and equitable and simple fee structure, described now onward.

(i) The establishments of autonomous water supply entity (WSE):

Another effective tool to improve cost-recovery and pricing is to make the irrigation water supply entity (WSE). Making the

WSE financially autonomous changes the incentives for cost recovery and pricing.

• If the WSE's are financially autonomous, they have a financial stake in using incentives and penalties to encourage farmers to pay their water charges. Incentives could include: providing high-quality and timely water service. Penalties could include stopping water delivery to defaulters, charging a higher rate for late payment, making farmers pay water charges before receiving any water, or all these measures. This can help to minimize the delay observed in the Irrigation Systems from Mafuiane, Massaca in paying for water usage.

• These WSEs also have a financial stake in providing their personnel with a positive incentive to deliver water on time, and in the right amount, as well as a penalty if they do not. For example, for failing to deliver water at the scheduled time and for the right duration, WSE personnel would be fined. Alternatively, good performers would receive a bonus. This can be helpful as all the irrigation schemes involved in this study have trained local personnel who responds to water delivery and the system maintenance as agreed by 82% of surveyed farmers.

• To increase its effectiveness, the water supply entity needs to consult directly with farmers when they are developing the water delivery schedule for the next irrigation season. After the schedule is developed, it should be widely advertised along with a statement regarding the water charges farmers are expected to pay. In addition, any changes in the schedule should be quickly conveyed to every farmer.

• The WSE will also have a strong incentive to invest in improved infrastructure to improve their control over water use. The improved water control will allow them to provide better services as well as better measures of water delivered. This will, in turn, make it easier to monitor and base fees on the quantity of water delivered. In several of the cases reviewed, improved water control saved water and enabled the WSE to increase revenues by selling the water they saved.

(ii) Equitable and simple fee structure

The fee structures have to be equitable, administratively simple, and easily understood by users and those administrating the fee collection.

• Part of this involves identifying the full range of services and benefits produced by the project and allocating project costs among all beneficiaries.

• In addition, information on the costs of services and benefits derived from the project and on the way project costs are allocated among beneficiaries should be provided to all users.

• For a new project or any major improvement in infrastructure, users' ability and willingness to pay should be assessed.

Recommendations

Recommendations are drawn for owners/public infrastructure beneficiaries and managers of the irrigation sector and to the Government through the Mozambican Ministry of and to those institutions interested in irrigation development in Mozambique, on the one hand, and for further research, on the other.

Recommendations for owners/beneficiaries of the Investment

Based on the findings and conclusions of this study, the following recommendations can be drawn for the owners/beneficiaries of the public investment for water infrastructure in the agriculture industry based on fact that Irrigation systems require strict operations and maintenance schedules:

1. Producers operating in irrigation systems developed under public investment should adopt an organisation mechanism that allows their participation, share and exchange of opinions and views on the development of technology, knowledge creation and dissemination, thereby ensuring their greater commitment on infrastructure operation.

2. It is also recommend that farmers establish within their organisation, a group dedicated to infrastructure operations and management, which will be responsible to manage the irrigation schedule and cycle in desired quantity and quality, leaving this group also, the maintenance of the system. This group will have real knowledge of the costs of water supply and all associated services, being able to discuss with the whole producers, the real and fair rate of water supply to be paid by each producer to ensure continuity of services quality and oversee and coordinate the working and interaction of all agencies and personnel engaged to work towards achieving the objectives of smooth O&M.

Recommendations for Government Irrigation Entities

The Government through the Ministry of Agriculture is recommended to adopt a collaborative participation in the design and implementation of water infrastructure development projects through public investment with great emphasis on establishing an interactive collaboration and participation with all stakeholders at every stage of program development and implementation. This active participation will be encouraged from the very beginning of the assignment, and will ensure that the desired outcomes and results achieved will be lasting and sustainable into the future. Participation includes not just beneficiary farmers, but also regional water services authorities at central and provincial level.

The key to ensuring the long-term success of the programme and for ensuring sustainable continuing effective water delivery and use; is the establishment of good interaction and collaboration at two levels, namely i) Between water users, who need the water; and water service providers who are responsible for delivering water to them, and who are responsible for the development, upkeep and maintenance of the national water system and its infrastructure, and ii) Between the members of the farmer group being serviced to ensure efficient, timely and equitable distribution of the water being delivered via the established infrastructure, and the care and maintenance of that infrastructure at district and field level.

Acceptance of the rationale for recovering on-going costs is almost universal in all developed infrastructures through public investment, even if implementation is not. Full or partial recovery of investment costs is more controversial because irrigation is often seen as development expenditure for backward areas, benefiting not only the poor farmers but also society more generally through lower food prices and food security. Where these costs are not recovered, governments should incentive and pay the difference, thus subsidizing the agriculture sector, a politically sensitive sector, avoiding the infrastructure deteriorations.

Public investments in agricultural water infrastructure and management should complement or strengthen the livelihood and coping systems of the rural poor (community based management), building upon local culture, knowledge and institutions, and promoting group participation among target groups, therefore, investments should deepen socio-cultural understanding.

Conclusion

The importance of irrigation water infrastructure in increasing agricultural production and in raising the incomes of beneficiaries is well recognized. Furthermore, Farmers are more likely to adopt innovations if they get direct benefits for

themselves rather than other demographic groups, therefore, on this basis, incentives, capacity enhancement are even more important as the beneficiaries are not the farmers but the consumers of their agricultural production. Irrigation infrastructure operators recover their on-going costs through a set of fees and charges. For cost recovery policies to be effective, the idea of charging for the extraction and delivery of water (irrigation infrastructure operation) has to be made acceptable to farmers. Policies of water pricing affect, and in turn, are affected by a large number of other important issues in the irrigated agriculture sector, for example, O&M needs; turnover and WUA; rehabilitation and modernization of the irrigation infrastructure; increasing competition for available water with other sectors/users; international trade and commodity pricing. Therefore, the introduction of a water charging policy should be part of a larger package of measures designed to move to a virtuous circle where farmers are willing to pay for a good service, with the revenue being invested in sustained and improved service delivery.

Full or partial recovery of investment costs is more controversial because irrigation is often seen as development expenditure for backward areas, benefiting not only the poor farmers but also society more generally through lower food prices and food security. Where these costs are not recovered, governments should incentive and pay the difference, thus subsidizing the agriculture sector, a politically sensitive sector, avoiding the infrastructure deteriorations. There must be clear linkages between Government public investments policy objectives in agriculture water infrastructure and charging methods, and consistency with other activities, in the irrigation sector.

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