



Faculty of Social Sciences

**THE IMPLEMENTATION OF IRRIGATION SYSTEM
THROUGH STAKEHOLDERS PARTICIPATION IN B8A
SECONDARY CANAL, CHU RIVER AREA, THIEU HOA
DISTRICT, THANH HOA PROVINCE, VIETNAM**

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Master of Environmental
Management in Development Planning
2005

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CHU RIVER AREA, THIEU HOA DISTRICT,
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ABBREVIATION

AC	Agricultural Cooperatives
ADB	Asian Development Bank
B/C	Benefit – Cost Ratio
CBA	Cost Benefit Analysis
CVM	Contingent Valuation Method
FIOP	Farmers Irrigation Organizing Programme
FMIS	Farmers Managed Irrigation System
ha	Hectare
IA	Irrigation Association
ICMs:	Irrigation Management Companies
ICOP	Irrigation Community Organization Programme
IDMCs	Irrigation and Drainage Management Companies
IRR	Internal Return Rate
kg	Kilogram
km	Kilometer
Md	Million <i>dong</i>
NGOs	Non Government Organizations
NIA	National Irrigation Administration
N ₀	Number
NPV	Net Present Value
O & M	Operation & Maintenance
PBV	Present Benefit Value
PCV	Present Cost Value
PIM	Participatory Irrigation Management
PLI	Poverty Line Income
<i>r</i>	Discount rate
S.M.A.R.T	Specific, Measurable, Assignable, Realistic, Time
SLUSE	Sustainable Land Use and natural Resources Management – Malaysia
SPSS	Statistical Package for Social Science
TA	Technical Assistance
VND	Viet Nam dong (Vietnamese currency)
UN	United Nation

UNIMAS	University Malaysia Sarawak
WTAC	Willing To Accept
WTP	Willing To Pay
WUAs	Water User Associations
%	Percentage

ABSTRACT

Following the policy on “the state and people working together”, farmers in different regions of Viet Nam have contributed significantly in investing, operating and maintaining irrigation systems at various levels. Thanh Hoa province is one of the first districts that have been implementing this policy in the North of Viet Nam, which focuses on B8A Water User Association (WUA) establishment. The purpose of this study is to find out the status and to assess the performance of the WUA through participation of the local people after seven years of operation. Cost - benefit analysis was performed to evaluate the efficiency of the project in terms of economics. The results show that this project bring not only private benefits but also public benefits to the community with value of NPV and B/C ratio of greater than 0 and 1 respectively. The efficiency of farmers’ participation is clearer through results of socio – economic perspectives. In terms of participatory irrigation management, users are actively involved in planning and implementing the process regardless of age. Results of correlation analysis found that there is no significant relationship between age of respondents and the participation of water users in various activities and function of the WUA. The study was also determined and comparing the difference of socio-economic aspects before 1998 (before the project) and present. The results of the correlation analysis were positive in terms of the total paddy production and the percentage of irrigated area in 2004, the average income, and the total agricultural production. A t-test was applied to analyze the significant difference in the level of income during the time before 1998 and 2004. The finding shows that there was difference between two average income levels at the two periods (before 1998 and now). In 2004, the average income was higher than that before 1998. The WUA establishment also had reduced conflicts and health care problems significantly.

ABSTRAK

Mengikut polisi “the state and people working together”, petani di pelbagai wilayah Viet Nam telah memberi sumbangan yang signifikan dalam melabur, menjalan dan menyelenggarakan sistem perairan di pelbagai tahap. Thanh Hoa adalah satu daripada wilayah yang pertama menggunakan polisi ini di, yang tertumpu kepada B8A Water User Association (WUA). Objektif kajian ini adalah untuk mengenalpasti status dan menilai prestasi WUA melalui penglibatan masyarakat tempatan setelah ianya beroperasi selama tujuh tahun. Analisis kos taedah telah digunakan untuk menilai keberkesanan projek tersebut dari segi ekonomi. Dapatan kajian menunjukkan bahawa projek ini bukan hanya membawa keuntungan kepada individu persendirian tetapi juga kepada komuniti secara keseluruhan dengan nilai NPV dan B/C ratio lebih dari 0 dan 1. Keberkesanan penglibatan para petani dalam projek tersebut adalah lebih ketara dari dapatan perspektif sosio-ekonomi. Dari segi penglibatan dalam pengurusan pengairan, para pengguna melibatkan diri secara aktif dalam proses perancangan dan implementasi tanpa mengira perbezaan umur. Analisis korelasi menunjukkan tidak ada perhubungan yang signifikan di antara umur responden dan penglibatan para pengguna air dalam pelbagai aktiviti dan fungsi WUA. Aspek sosio-ekonomi juga telah diaplikasi di dalam kawasan kajian untuk menentukan perbezaan di antara sebelum 1998 (sebelum projek bermula) dan sekarang. Keputusan dari analisis korelasi adalah positif dari segi jumlah pengeluaran padi dan peratusan kawasan pengairan pada 2004, purata pendapatan, dan keseluruhan pengeluaran pertanian. T-test telah digunakan digunakan untuk menganalisa perbezaan yang signifikan di antara tahap pendapatan sebelum 1998 dan 2004. Hasil kajian ini mendapati perbezaan diantara kedua-dua tahap purata pendapatan pada dua masa tersebut. Pada tahun 2004, purata pendapatan adalah lebih tinggi daripada 1998. Pertubuhan WUA juga telah mengurangkan konflik dan masalah kesihatan secara signifikan.

CHAPTER 1

INTRODUCTION

1.1 Background

Water resources play a key and important role in our lives, especially for agricultural activities. Moreover, water resources are limited although renewable, they are depleting by the day without well-controlled management. This has been expressed in many researches, which have reported that water resources should be valued as one kind of asset.

Nowadays, the world population growth is increasing very fast. In 1999, the world population was about 6.0 billion and the number would reach to around 7.5 billion in 2020 (UN, 2000). With the increasing population and food shortage, the situation may worsen in the absence of rational water management policies. Hence, the challenge face by the irrigated agriculture today and in the future is how to produce more food and increase farmer's income with less water. Therefore, the water works play a key role in managing and controlling water resources efficiently in terms of water demand and supply towards food security.

Viet Nam is considered as one of nations that have developed irrigation system in ASEAN region. Irrigation systems are not only supplying water for agriculture but also for industries, transportation and improving living standards. Hence, hydraulics construction plays a significant in the development of agriculture and rural areas in Viet Nam.

However, finding way and means of improving the productivity of overall water resource has become a critical need for achieving sustainable improvements in irrigation performance (Bruns, et al., 2001). Nowadays, stakeholders are encouraged to use the irrigation systems efficiently through participation in irrigation management (Svendsen, et al., 1997). The Participatory Irrigation Management (PIM) plays an important role in meeting the need of water in a sustainable and efficient way.

1.2 Participatory Irrigation Management in Viet Nam

First of all, the term PIM term can be defined as the involvement of irrigation users in all aspects and at all levels of irrigation management (Groenfeldt, 2000). “All aspects” means all works, which relate to irrigation management such as planning, designing, construction, improvements, financing, operation, and maintenance. Irrigation management is carried out at “all levels” that is multilateral, running from the bottom upwards. Participation focuses on increasing stakeholders responsibility in development initiatives with decision-making involving farmer beneficiaries, staffs of irrigation agencies and other who are effected like water users.

There were major institutional and economic reforms as well as changes in agricultural policies in Viet Nam in the late 1980s. The promotion of the responsibility system in cultivation and the allocation of land allow farmers to choose input supplies and secure of land tenures. As the result, the economy was strengthened and the condition for sustained economic growth. The economics system has also changed from centralized to market – based economy , in early 1990s. At present, Viet Nam is self – sufficient in term of food supply and is one of the world’s leading rice exporters. Focusing on the sustainable development of agriculture is still one of the government’s

main strategies to develop the country. In order to achieve goals of this plan and also to ensure food security, water conservation and environmental protection, hydrological systems have been developed and improved continuously.

Nowadays, there are 130 State owned enterprises or Irrigation and Drainage Management Companies (IDMCs), which not are including the irrigation management stations and the management boards of separate hydrological works which cover 91% of irrigation system and serving 80% of total irrigated area. More than 10,000 agricultural cooperatives are taking responsibility in managing the irrigation systems and also the large and medium – scale drainage systems. Another 2,000 WUAs are working as a “bridge” between IDMCs, local authorities and farmers. There is only 9% of the irrigation system, which account for 20% of the total irrigated areas are managed by the farmers (Pham, 2004: 27).

Awareness of the government on the roles played by the farmers resulted in the development of a few specific policies to fortify PIM development as follow:

- Revolution No 6 dated October 11, 1998 by the Political Bureau on agriculture and rural development issues promote *policies on encouraging the participation of farmers in investment and irrigation system management.*
- Resolution No 6 dated on March 18, 2002 issued by the Central Party Committee to put emphasis on the development of WUAs and water management by farmers.
- Decision No 58/2002/QĐ – TTg date on April 26, 2002 by Prime Minister emphasizes the role of specific organization, especially structures within a village or commune in managing irrigation structures.

Parallel with the government monitoring, there are various supports from international organizations in PIM implementation such as ADB, World Bank, DANIDA and various NGOs. From 1993 to 2003, ADB has financed 40 major projects that focus mainly of agricultural activities on irrigation, rehabilitation and strengthening of drainage (Tran, 2004).

In term of PIM, there are several models, which have been implemented under different organizations in different localities as following:

- Inter - commune model (3-4 communes each): this model is a combination of three or four communes which out of administrative boundaries aim to manage large and medium - sized (300 –500 hectares) canal system. This model is practiced in Thanh Hoa, Nghe An, Thai Binh province under the names: Water Use Cooperatives (WUCs), and Water User Association (WUAs), or Agricultural Cooperatives (ACs). The application of the model has reduced the number of redundancy of IMCs as well as strengthening the role and interest of the water users.
- Inter – commune model (1- 2 communes each). One or two communes are combined together to control the smaller irrigated area (less than 200 hectares). This model is very common in Tuyen Quang, Thai Binh provinces under the Management Units or Cooperatives. The principle action of the Management Units action is similar to ACs, but it is more independent because they have their own bank accounts at the State treasury.
- One – commune or inter – village model: This model is applied within the administrative boundary of one commune or village. They manage a large or medium- sized to small one such as pumping stations or reservoirs under the

different name like ACs, WUAs and WUCs. However, ACs are the most known in this model.

In this paper, inter – commune model within three – four communes each is applied for Thanh Hoa province under B8A WUA. The operation of this model is simple. WUA is a farmer's organization whose main functions are to operate, maintain, and manage the irrigation system. The water users in the irrigation districts or units select the WUA's board of directors who will represent their rights in the communities.

Under the resolution No 9 of Thanh Hoa province in 1995 about improvement of cooperative society and economic development in rural area, official letter No 851 on the implementation of TA 1968 - VIE project on 10th May 1996 was issued. B8A WUA was established in 1998 under cooperation between TA 1986 VIE office of Ministry of Agriculture and Rural Development, and managed by the Chu River Irrigation Management Company and legally licensed by Chairman of Thieu Hoa district People's Committee. The WUA covers three communes Thieu Chinh, Thieu Hoa, Thieu Toan, which are located in the northwest of Thieu Hoa district in Thanh Hoa province. The B8A secondary canal with the length of is 4km, running through the three communes with the main purposes of supplying irrigation water for 401 ha of 11 hamlets as well as providing domestic water to more than 10,000 local people (Nguyen, 2004).

1.3 Location

The project site is located at the Chu River area in Thanh Hoa province, Thieu Hoa district (Figure 1.1). Chu River system is on latitude 19°45' to 19°55' and longitude 105°30' to 105°50'. Chu River irrigation system supplies water for agricultural

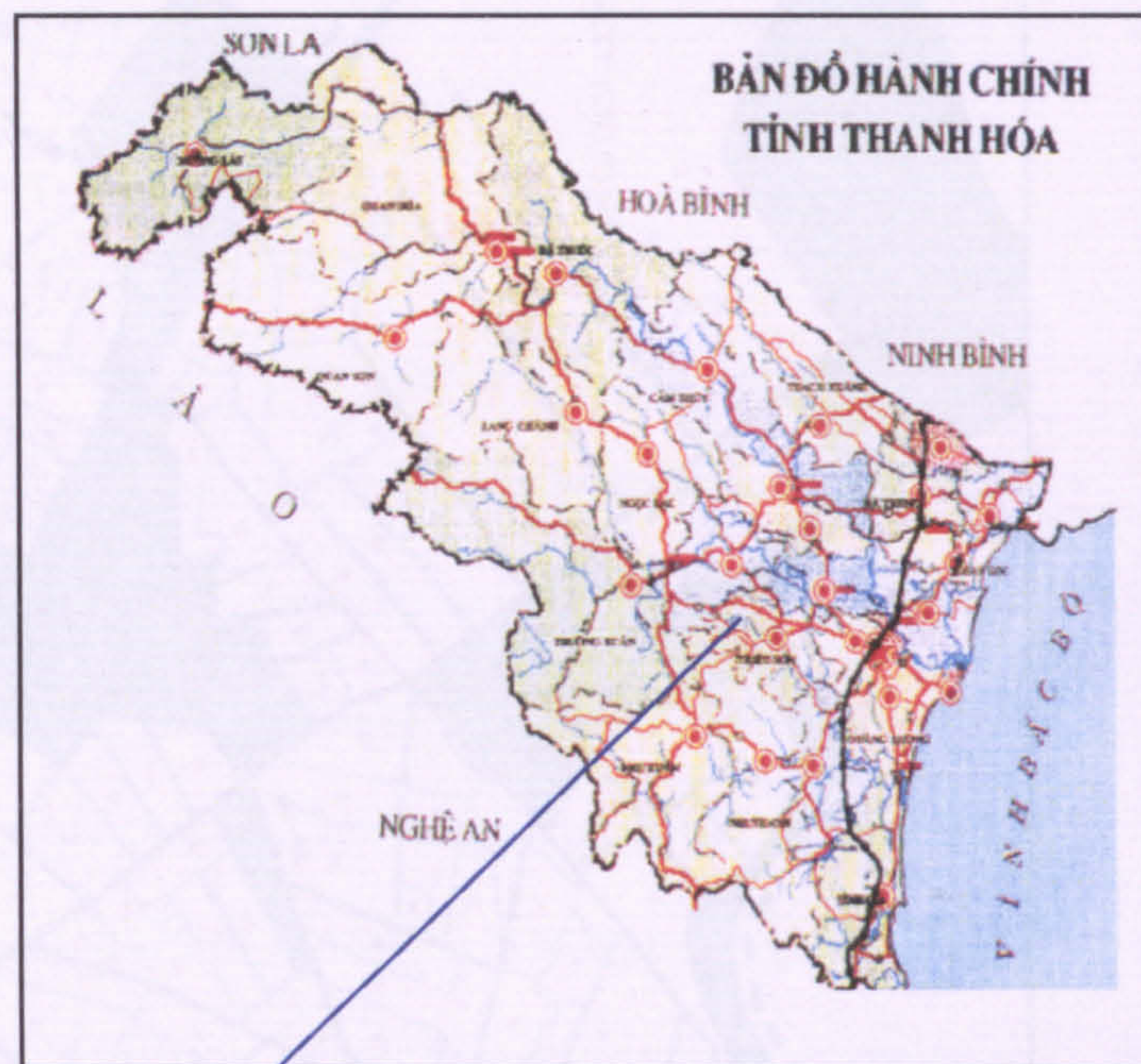
activities in whole Thanh Hoa province. With the topography characterized by slopping terrain from the North West to the South East, which is in the same of direction Chu River's flow, it can really suitable for supplying water resources under itself-sufficient manner.

Thanh Hoa province has a tropical monsoon climate with a warm and rainy season from June to November and dry season from December to May in the following year. The mean of annual rainfall is about 1,591mm, that occurs mainly between May and November which account for 85% total flow of rainwater in this area (Thanh Hoa Statistical Year Book, 2004).

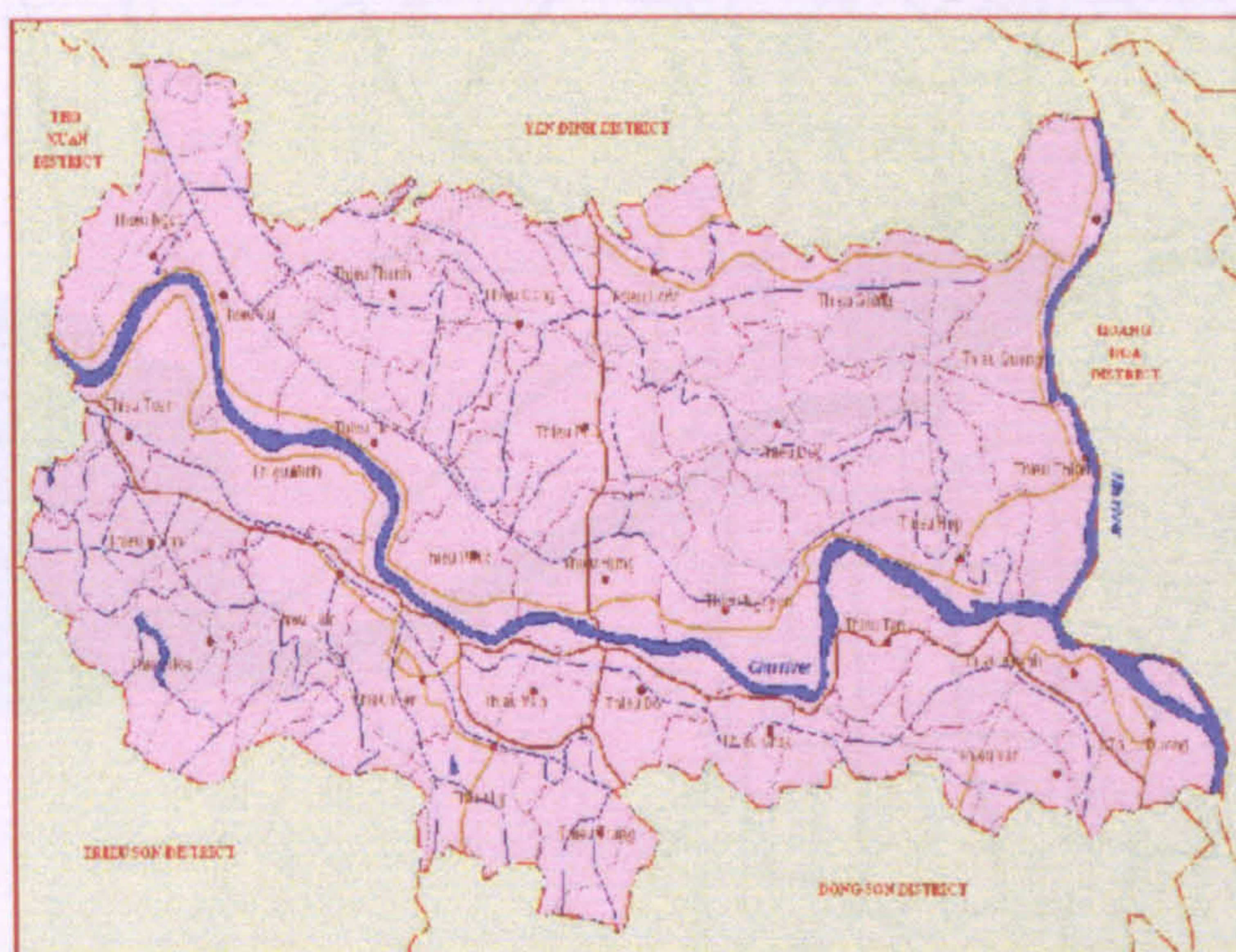
This study focuses on the B8A secondary canal (Figure 1.2), which belong to the Chu river irrigation system and beneficiaries in three communes of Thieu Chinh, Thieu Hoa, Thieu Toan in Thieu Hoa district, Thanh Hoa province. The study location is selected because it is one of the first places to implement an irrigation management through WUA.



Viet Nam Map



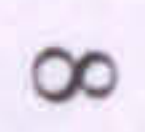
Thanh Hoa Province



Thieu Hoa District

Figure 1.1 Vietnam , Thanh Hoa province, Thieu Hoa district map

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1.4 Problem Statement

Most of the irrigation systems in Viet Nam are funded and built by the government, while the Irrigation Management Companies (ICMs) are put in charge of the operation and maintenance of the irrigation. Farmers are charged for water usage and this fee depends on the size of their land. This means the bigger the land they have, the more they have to pay. However, as some farmers do not have the means to pay in cash, they are allowed to pay in kind or barter trade. Maintenance of the irrigation canals are costly, hence there are needed of prompt payment from the users. Unmaintained canals would mean less water and thereafter loss in crop production. Local people, however, they still believed that the canal should be maintained by the government. Therefore, they pay little attention to payment of water fees and canal maintenance. Moreover, the local authorities and farmers are likely to get subsidy and benefits from the government. These factors place the government in a difficult situation to manage the irrigation systems.

The fact is, an average irrigation system cannot be used efficiently and only operates at 50% – 60% of its designed capacity. This is an issue of great concern in the inter – commune canals, especially when water wasting phenomenon occurs in the upstream communes causing shortage of water in the downstream areas. The shortage of water causes the increase of service costs as well as disputes between water users in these communities. Consequently, irrigation systems are deteriorating and hence low in efficiency (Nguyen, 2004).

The irrigation capacity is also influences by the weather and geographic conditions. In Thanh Hoa province, most canals in the Chu River irrigation system are prone to erosion and siltation. Usually, from the April to November the canals are filled to

about 85% of its capacity. However due to the poor management practices, the canals would be dried from December to March in the following year. Thus, a proper water resources control and management is important to ensure that the canals are well filled throughout the year to keep the crop production at its full capacity.

A collaborative efforts of the government and each individual farm household is need since the operational and maintenance problems of the irrigation system cannot be solved by either one of them alone. Therefore, it is a necessity for the local communities and government to work together to maximize the benefits from the irrigation systems. According to Meizen - Dick (1997), there are various examples in the world that emphasized on the involvement of farmers in irrigation schemes. The efficiencies under economic and social aspects are obtained through participation of water users. One of the most readily apparent visible effects on farmers' involvement in irrigation management is the decrease in the government costs and reduced administrative budget. Furthermore, the improvement in water delivery services has helps to reduce the conflicts and creates equality of water distribution between users. With a better water delivery services, farmers' productivity as well as their income will be improved.

1.5 Purpose and Objectives

1.5.1. Purpose of the study

The purpose of this study is to assess the implementation of the B8A irrigation system through participation of the local stakeholders communities in Thieu Hoa district, Thanh Hoa province, Viet Nam.

1.5.2. Specific objectives:

The objectives of the study are as follows:

- i. To determine the socio – economic status of the people in the study area,
- ii. To identify the legal institutions and regulatory of the WUA of the study site,
- iii. To assess the level of community participation in the planning and implementation process,
- iv. To evaluate the benefits and costs of the irrigation project (NPV, B/C. IRR of this project), and
- v. To identify and evaluate the social and economic impacts of the irrigation schemes on the stakeholders based on the following parameters: agriculture production, standard of living, water supply, and health care.

Hypothesis: It is believed that there is a significant relationship between irrigation management and participation of water community in various activities and function of the association. In order to assess the efficiency of B8A WUA establishment and perception of participants, the following hypotheses were formulated:

1. There is a significant relationship between the total paddy production and the percentage of irrigated land in 2004.
2. There is a significant relationship between the mean income and the total agricultural production.
3. There is a significant difference in the levels of income during the time before 1998 and 2004.
4. There is a significant relationship between age and the participation of water users in various activities and function of the WUA.

1.6 Significance of the study

Irrigation schemes are essential for agricultural country like Viet Nam. Hence, the use and management of this scheme efficiently are necessary to obtain maximum usage. Since the study evaluated the new model in management and operation of B8A secondary canal and also assessed its the social and economical impacts of the farmers, it is hope that the study will provide valuable information the version stakeholder. For the government, it will reveals users' perception and expectations of the government role in the irrigation systems. For farmers and other relevant agencies, it will help them to understand their role thus to ensure the success of any irrigation systems now and in the future.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the general steps in project planning and implementing which focus on methods to meet the local needs and project cycle. Moreover, participatory irrigation management concepts and experiences in the world are also mentioned. Finally, level of participation, user satisfaction and cost benefit analysis are used to evaluate and reassess of irrigation project.

2.2 Project Planning and Implementation

2.2.1 Methods of planning to meet the local needs

The needs of the local people are always central point for each project. The success or failure of projects depends on how it can meet these needs. However, in order to get achieve these targets, the developers have to understand the local community well through direct involvement and allow the local people to voice their views. There are several methods that can be used to identify the local people needs as reviewed in the following sections.

2.2.1.1 Participation

First of all, participation is considered as an effective way to get ideas or opinions from community. Participation is defined as “a process through which stakeholders influence and shared over development initiatives and the decision and resources which affects them” (Long 2001:14). Everybody, whether an individual or organized groups in the community can be involved, exchange information and express opinion on the decisions making and implementation plan. They all have the potential to

influence decision at all levels of the projects. Participation is one of the crucial ideologies in community development. It has been applied widely, but can only be achieved when people are motivated, however, people motivation depends much on their perceived and expected benefits from their involvements (Lisk, 1985). Therefore, the participants must be motivated to ensure the high success rate of this technique.

2.2.1.2 Meetings

Another method of collecting information from the local people is through meeting. According to Rubin (1992: 217) “ meetings create a commitment to action by creating a shared interest in a problem, democratically determining collective solutions and building the skills required to carry out the decision made by the group”. At meetings, the problems that the community is facing are discussed among the people, and each individual can give their own ideas on the solutions. Normally, the planners or developers will study the problems of the area that need to be developed. Through meetings with local people, planners or developers can know local opinions as well as the aspirations, which will be critical to the success of the projects.

2.2.1.3 Dialogue

Dialogue is an open communication interactive system that ease community participation. Through dialogue, which is a two – way communication process between the developers and local people create clearer understanding of the policy or plan that are being implement. Dialogue between the developers and the local people may motivate them to participate in the development projects.

2.2.1.4 Mobilization

According to Rubin (1992: 191) “mobilization is the process of moving personal grievances to realm of collective action”. By mobilization, people are convinced to work together and encouraged to be more active in the community organization. Organizers play an important role in persuading people especially those who are still unwilling to get involved. This is vital because the main purpose of mobilization is to focus on getting people to participate and contribute to the achievement of community development goals.

2.2.2 Project cycle

In general, project includes numerous activities, which are sequence process from beginning until the end and known as a “project cycle”. According to Gittenger (1982), project cycle is divided into five main phases that are identification, preparation and analysis, appraisal, implementation and evaluation (Figure 2.1).

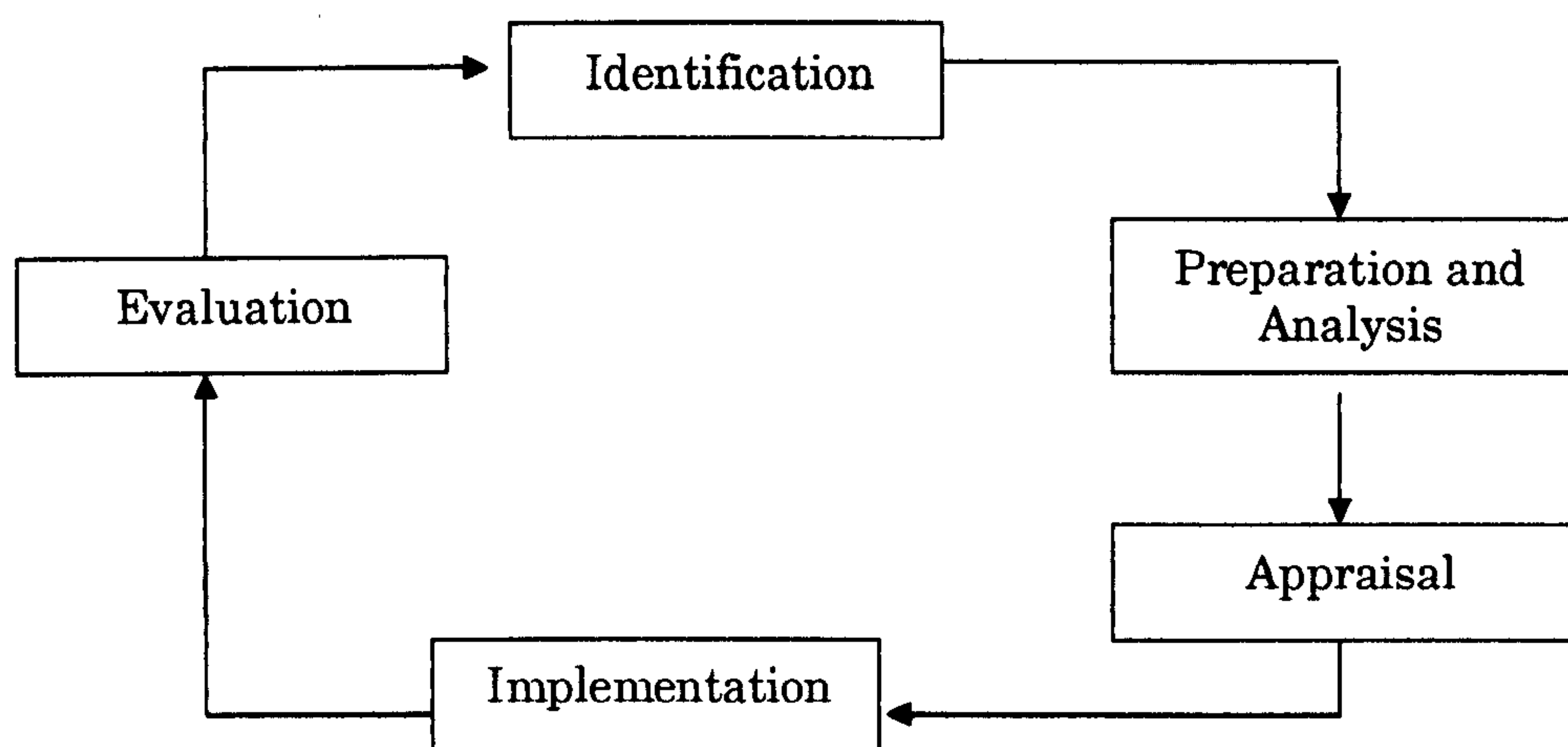


Figure 2.1- Project cycle

2.2.2.1 Identification

For any project, identification is the initial stage of a project. The decision to carry out projects are usually depends on the suggestions from the technical specialists and local leaders. The information from technical specialists will determine which areas to be selected and whether it will be profitable. Local people's suggestions will contribute to affirm the implementation capacity of the projects. For example, in an irrigation project these suggestions will decide on where the irrigation system can be located. A survey is usually needed to gather suggestions. The survey is used to investigate the current status of that area as well as to predict the demand of the project by the local people or any sector in the economy such as agriculture or industry in the future. The implementation of the survey might involved the participation from international agencies or certain agencies that are providing bilateral assistance.

2.2.2.2 Preparation and analysis

After the project is identified, the next step is preparation and analysis of the project plan. At this phase, the project will be analyzed in detail, and if the results are favorable, the project will be implemented.

At this stage also, a feasibility study will be carried out. In this study, information will be collected and collated for the project decision. Project objectives should also be known through the feasibility study. Objectives of projects must be S.M.A.R.T – specific, measurable, assignable, realistic and time – related (Weiss & Wysocki, 1992). The detailed planning and analysis can only be started when the feasibility has indicated the benefit of the proposed project. Clear and careful preparation will facilitate implementation, thereby contributing to project efficiency.

2.2.2.3 Appraisal

The main purpose of appraisal is to review and assess all aspects of the project. Through appraisal, questionable data or faulty assumption will be analyzed again, redo and improved. Project plan is modified at the appraisal stage. The appraisal process decides the implementation of the project. If the appraisal results are good, the investment may be continued. In contrast, new plans will be replaced or the plan must be adjusted correctly if the results are unfavorable.

2.2.2.4 Implementation

This stage is regarded as a crucial part of the project cycle. Project implementation is carried out after all aspects of project's plan are examined. The role of project planning and analysis are emphasized since whether the expected benefits can be obtained or not depends on the careful preparation of the plan. Moreover, project implementation must be flexible because of inevitable changes such as price or technology changes. In this case, project managers have to make proper adjustments to the plan in order to accommodate those inevitable reacted changed.

Project implementation stage is divided into three different time periods, which are the investment, the development and the duration of the development period (Gittinger, 1982). The investment period starts when the major project investment are agreed to perform. For instance, in an agricultural project, the investment period is from three to five years since the project started. Usually, the development period is known when production of the project is created. Finally, the duration of the development of the project referred to the rate of adoption of the project technology. For example, in agricultural projects this time is identified when the farmers are applying and absorb new technology provided by the projects.

2.2.2.5 Evaluation

Evaluation is the final stage of the project where the project will be assessed. It provides information for future project. Evaluation is carried on the project has been completed and also when there are problems in the project implementation. It should also be performed regularly to help the managers to compare the completed works with the objectives, which are primary criterion for an evaluation. If the results are not as expected, the objectives and the operations should be reexamined until they are better (Gittinger, 1982).

2.3. Participatory Irrigation Management (PIM)

As mentioned earlier, in PIM, all irrigation users can be involved in irrigation management at all levels. People who are responsible for PIM participate are not involved only in the operation and maintenance (O & M) and financing but also in making any decision relevant to O & M. Participation has both positive and negative impacts on four perspectives, which includes government, irrigation agencies and farmers. From the government perspectives, the changes in management structures and process have helped to reduce cost at both government and civil service staffing levels. However, government's control over cropping patterns is also reduced. From the perspective of irrigation agency, their control over water resources, bureaucratic and political influence has been limited by the participation of the user associations in irrigation management. On the side of the farmers, their participation in irrigation systems management has reduced the conflicts among users, improved maintenance, and increased transparency of process, created sense of ownership, and also improved agriculture productivity. However, transferability of irrigation system management to the water users required more time, effort and technical assistance (Bryan & Helmi, 1996).

Studies by Sengupta (1993), indicated that the farmer involvement in the management plays a significantly role in areas that bureaucratic management performs poorly. More irrigated area are extended as more water reached to the farmers at the tail ends. According to Giriappa (1983), irrigation usage efficiency is not only in term of economics but also in terms of engineering, social and environmental which maximize the financial return per unit of water applied or amount of money invested in the irrigation projects. Social benefits of an irrigation system include maximizing benefits to the for farmers with an optimal crop – mix in larger areas. In term of environmental benefits, an irrigation use efficiency should also improves the ecological balance and sustains the soil – water – plant relationship. Hence, the policy of the Commission on Water, which emphasized on the old model of “this is government’s business” must be replaced by a model in which stakeholders participate at all levels. However, the government still plays an important role in supervising as well as providing technical and enforcement supports while the communities have to design and decide on what is to be done, how it is done and who pays for it (Tortajada, 2000).

According to Svendsen et al., (1997), there are various forms of activities and responsibilities that water users can be involved in during the implementation of irrigation system. These activities are including those the planning, design, operations, maintenance, rehabilitation, and resource mobilization stages as well as conflict resolution. Furthermore, they can also be involved in these functions from the root level up to the higher management level.

2.3.1 Organizational Arrangement

The nature of the user organization change from country to country and even within countries, it may be referred as a water user association (WUA), farmer's council, irrigation union, irrigation association (IA). For consistency, we use the term "water user association" to indicate such organization.

WUA which is established by the local users is known as a local – level organization of the irrigation in that its action depend upon water users' involvement in organizing, operation and maintenance of the schemes. Normally, WUA is established as depicted in Figure 2.2. The Board or council representatives are elected and empowered by a joint agreement for every two or three - year. The council guides the operation of the local irrigation community to implement the agreed programs with the established agreement with the public and legal assurance of the stakeholders. WUA have meetings periodically to set up policies. According to Freeman, any director or staff such as secretary, treasure, and managers of the WUA is basically aims to:

- “1. Allocate water according to the organized share distribution system.
2. Maintain the local irrigation facilities for which the organization is responsible with resources collected from the share holding membership according to the rules specified by the share system, and
3. Manage conflicts among irrigators through the board administration with appeals addressed to the board. If conflicts cannot be satisfactorily resolved at that level, it would have to go to the formal legal system” (Freeman, 1991: 65).

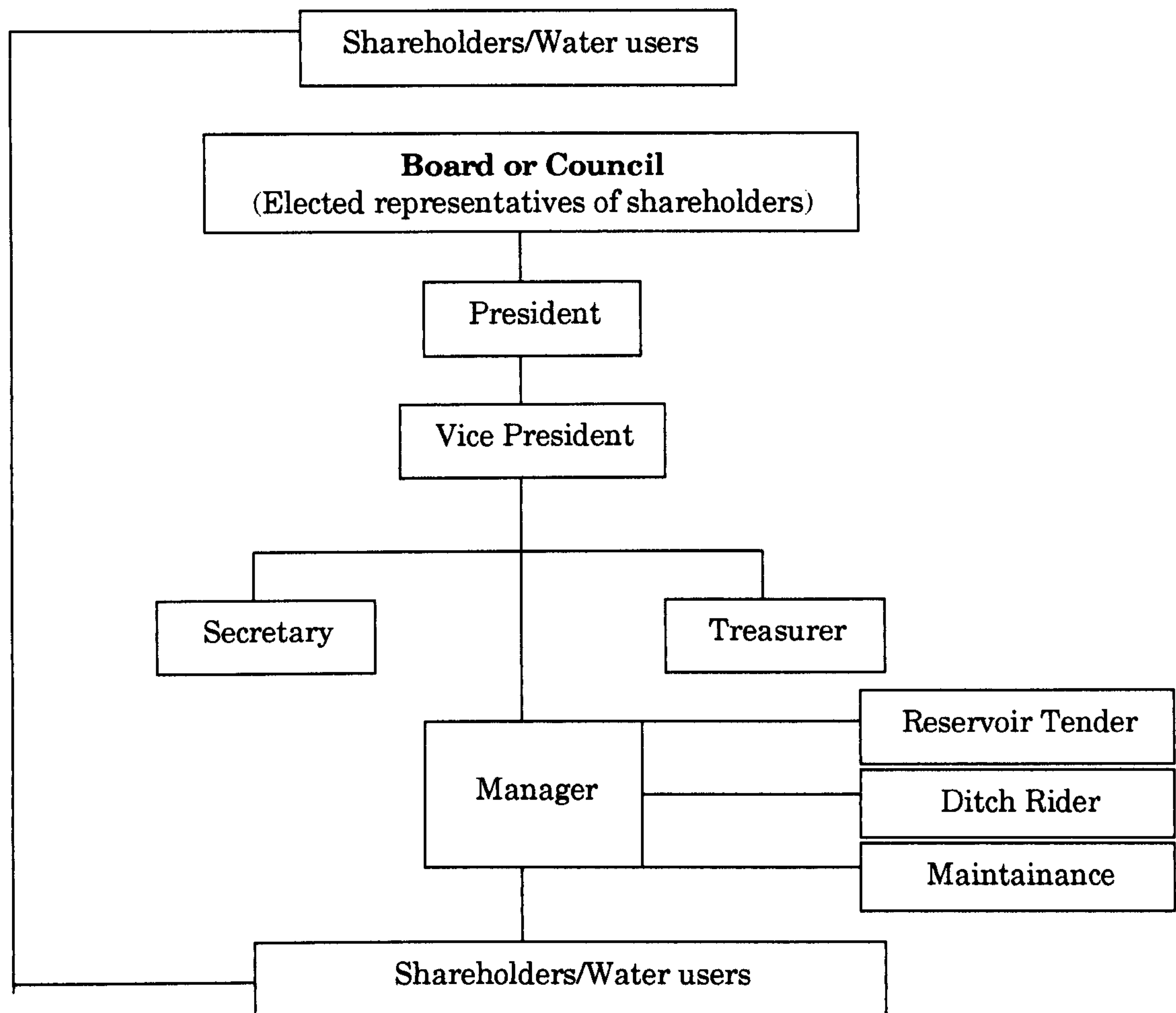


Figure 2.2 Structure of Water User Association

Source: Freeman, 1991: 65

According to Snellen (1996), WUA helps to distribute water for users equally. It plays an important role in maintenance, operation irrigation system and collecting water fees from its users as well. Therefore, conflicts between users decrease significantly. However, there are four factors contributing to the strength of WUA which are defended by the legislative, executive and judicial government offices. These factors are financial- management; autonomy; capacity and reliability of water supplies (Burt & Styles, 1999). WUA can be independent in collecting water fees and spending them. It is, however, autonomous in the framework of the organization. The capacity of strong WUA is the technical training, managerial skills and also the functional

physical infrastructure. WUA must ensure a reliable and equitable water supply to users, especially the farmers, for their principal aim of WUA is to satisfy the needs of farmers. Therefore, hired staff of WUA need to be close to and understand the farmer needs. This is a contrast to the government employees who are probably unable to pay attention to users' needs.

Burt and Styles (1999) found five main types of WUAs which are operating in different countries where management irrigation system is concerned. Firstly, functional organizations are very popular in the countries like Mexico, Dominican Republic, Colombia and Turkey. The main function of these WUAs is to provide necessary knowledge for the farmers about water management. This is done through hired professional staffs who collect water fees and control water distribution equally to the users within their area. The characteristic of these WUAs is business like management system. The board that has been nominated by users is permitted to make and carry out programs related to economics and policies of the organization. This type of WUAs aim to be self - sufficiency in the financial aspect. However, a mixed up results of positive and negative impacts. Significantly, the number of former government employees was reduced when the WUAs in Mexico were established in the past decades. On the other hand, the conflicts and squabbles occurred in Saldana because of the board members, which one side of them were small farmers and the other side were large group of farmers who wanted to make more business – like decisions.

Secondly is the *Comites Paritaires of offices du Niger* in Mali. The principle of this organization is not the same as those in the Latin America. The *Comites Paritaires* were given a 50 percent voting right in deciding how to spend O & M funds, which

collected from the users. Furthermore, they did not participate in the irrigation operation or management with the farmers. It is considered as “ a good intermediate or even final step for WUA organizations where there are many small farmers with little skills in organization or budgets” (Burt & Styles, 1999: 128).

Thirdly is non – functional. These WUAs can be found in Lam Pao, Majalgaon, Bhakra and Dantinada regions inMorocco. The characteristic of these WUAs from the sociological aspects, which is the opposite to the business perspective known in Mexico. They have many responsibilities but not much power in the management system. The function of these WUAs are mainly cleaning the canals, cooperation in water distribution and fees collection. As a non – functional organization, it has a difficult in encouraging individual farmers to work and take the leadership role in organization. However, these WUAs do represent the users by voicing their request and complaints to the project.

Fourthly, mini – estates which are established by joint venture between developers and farmers such as in Malaysia. Mini –estates are created with units of 20 - 40 ha farmland. The participants within a block can be coordinated to planning, and help to manage its operation. Established mini – estates contributes to conflict reduction among users.

Umbrella associations are the final type of WUAs. This type of association can be found in Rio Mayo. Umbrella associations supply water to smaller WUAs and its board includes all members of each association. “The umbrella association is responsible for O & M between dam which is federally owned and operated and the individual WUAs” (Burt & Styles, 1999: 129).

2.3.2 Farmer's participation in irrigation

During 1950s and 1960s, the thinking was that water management mainly belonged to the State. Water control was considered as a public good service that the government provided. Thus farmers were depended much on water supplied by the state. The involvement of the farmers in management of the irrigation systems was limited despite being farmers – managed irrigation systems (FMIS) in the 1960s and 1970s. Until 1980s, there were several programs with the purpose of encouraging an organized participation of the farmers. Farmers were encouraged to participate in the management of irrigation system in term of inputs, decision – makings as well as their responsibilities for O & M of specific units of system (Meinzen – Dick, 1997). Globally, there are various countries that implemented PIM model with different achievements.

2.3.2.1 The Philippine case

Philippine is one of the countries that have experience in reforming water management from government alone to farmers' participation. Farmers' involvement in management of irrigation system were started in 1976. Water shortages happened frequently. In the national system, 80 percent of the service area was irrigated during the wet season and only 30 percent during the dry season (Bagadion, 1991, Parlin & Lusk, 1991). Farmers have to depend on water supply from the government. However, inequity in water distribution and unsatisfactory service caused conflicts among users. Farmer's initiative for self – reliant O & M of their irrigation system was not approached. Moreover, Philippine is one of the countries with the economy based on agricultural sector. Therefore, in solving water shortage through reforming water management, the role of farmer's participation is crucial, necessary and urgent in the Philippines.

National Irrigation Administration (NIA), belonging to the government is the main body responsible for managing irrigation systems in the Philippines. The government provided funds to NIA to construct and rehabilitate irrigation systems. In order to encourage and empower management of irrigation system for organized farmer cooperatives or association, NIA set up programmes for farmers like Irrigation Community Organization Programme (ICOP), Farmers Irrigator Organizing Programme (FIOP). These programmes help farmers to participate with the government to manage irrigation system efficiently. For instance, ICOP was started in 1980 and covered 31 systems distributed in all NIA regions. The farmer irrigator association was expected to manage rehabilitate, operate water system within their zones. With NIA technical assistance, the farmers irrigator association can conduct their activities themselves like establishing organization, collect fees, maintenance works and so forth. Normally, the turnover of O & M responsibilities are implemented after farmer irrigator associations has been organized under three stages as in the following:

Stage I - There is agreement between the farmer organization and NIA in managing a certain length of canal. NIA still plays an important role in major repairing and providing a fixed annual payment. The association helps NIA to manage water distribution and collect irrigation fees. The association received about 25% of the collection.

Stage II – In this stage, O & M are turned over to the irrigation association (IA) such as rehabilitation irrigation system, equitable distribution water among users, water fee collection. Fifty percent of water irrigation services was given to IA.

Stage III - All the O & M responsibilities are turned over from national system of about 2,000 hectares to communal systems in the long time and IA have to self – manage, organize and pays amortization to NIA (Kashoven, et al., 1989).

The NIA has still to manage and be responsible for to the main systems. Together, the IAs have managed the tertiary systems with NIA's support such as technical assistance and heavy equipments. The organizational structure includes people who are given different tasks like the general assembly of farmers, the board of directors, president, vice president, secretary, accountant, business manager and sector leaders. The officials are normally elected not only from the government but also from the community by farmers. Officers of the IA play important roles in ensuring the appropriate functions of the association, legislating policies for the approval of the general membership as well as management and carrying out O & M activities.

As mentioned earlier, farmer participation is taken under the form of IA which implements water management in term of physical rehabilitation and O & M. Obviously, farmers play a crucial role in participation of irrigation management. They are involved in discussion with the engineers in surveying for planning, designing of the irrigation systems as well as in construction works. As the result, the rate of fee collection of the irrigation system had increased from 47% in 1984 to 51% in 1987 and reach to 54% in 1990. Furthermore, the numbers of NIA working staff had decreased by 31% (from 10, 255 in 1986, to 7, 077 persons in 1996 during the period of national-wide implementation of PIM). Additionally, the conflicts between water users have declined and water are distributed more equably (Raby, 1997).

2.3.2.2 The Indian case

India is known as country with rapidly growing population and about 75 percent of population is still rural and rely heavily on agriculture (Singh, 1991, Parlin & Lusk, 1991). However, severe weather condition and unpredictability of rainfall and uneven distribution as well has caused famine in some parts of the country. The role of the farmer was not recognized or often neglected in any state – owned system. The government irrigation agency controlled every relevant water management activities like from distribution, maintenance to fee collection. It could be said that farmers are ignored in management irrigation system in India. This problem was known only after the experience from the Philippine, Bali, Java, Taiwan, Spain (Parlin & Lusk, 1991). Farmers are encouraged to participate with the government to manage irrigation system through WUAs. According to Raju (2001), participatory irrigation management of WUAs in India has resulted in improvement in the sustainability and productivity of irrigation through self – financing in autonomous irrigation projects managed by WUAs. The role of government was as provider of technical assistance. Farmer's participation contributes significantly to success in water management. First of all, the net area irrigated increased obviously in various areas. For instance, in Mula of India, the total net irrigated area increased from 7.2 hectares in 1981 and 1982 to 43.2 hectares in 1985 and 1986. Water is used economically. It is recorded that suitable controlled application of water has saved up to about 40 percent. Furthermore, the irrigation system is maintained carefully through farmers; contribution which is under the form of money. It is estimated about 830 rupees per year for an average outlet command of 50 acres. Farmers are willing to maintain not only main irrigation system but also minor ones that are ignored because of inadequate funds at the disposal of the irrigation agency (Singh, 1991, Parlin & Lusk, 1991). After WUAs were established, many canals that were 10 or 20 years old and had never been maintained were

repaired, rehabilitated as well as cleaned and removed of shrubs. As a result, the production and productivity level had increased because of water distribution practices by the WUAs. For example, the productivity of paddy had improved from 2.5 tons/acre to 3.5 tons /acre in 1997 in Andhra Pradesh. Furthermore, the irrigated areas were expanded, and the number of farmer complaints has reduced drastically. The water distribution was more equitable between water users (Raju, 2001). The role of the PIM can be described as in Figure 2.3 below that illustrates the complete cycle of PIM impacts.

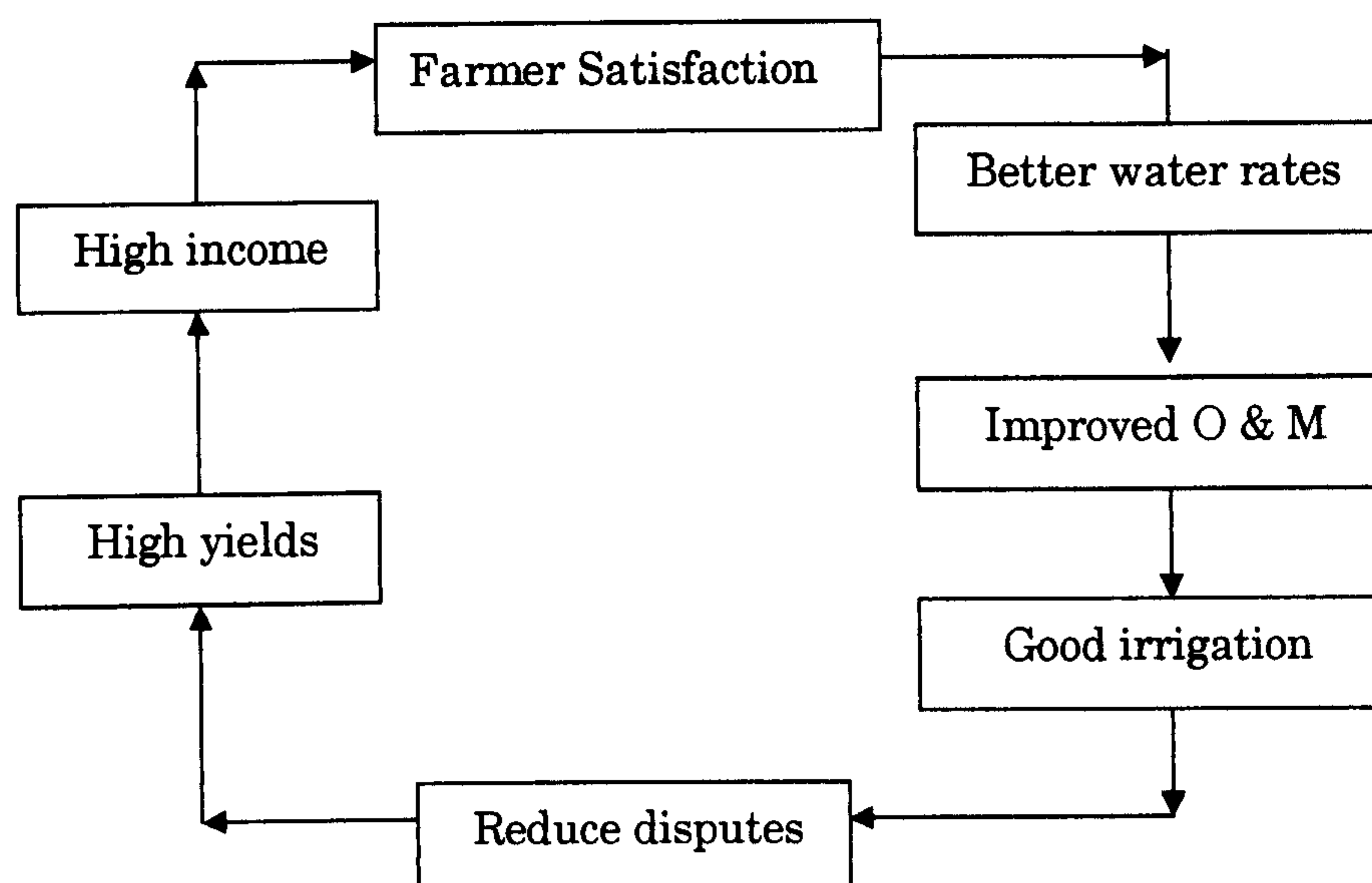


Figure 2.3: The cycle of participatory irrigation management impacts

2.3.2.3 The Mexican case

Mexico is considered as the example of demand management reform because of the crisis situation in irrigation system financing in the early 1980s. At that time, irrigation system had poor maintenance and it was estimated “1.5 million out of 6.1 million hectare of land went out of irrigated production” (Meizen – Dick, 1997: 108) by the end of 1980s. This problem was caused by lack of government’s funding for

implementing adequate O & M. In order to solve this problem, management turn over responsibility from the government to farmer's association and this was regarded as the quickest and most effective way. The first irrigation district was transferred to the users in 1990. It was recorded about 3.2 million hectare irrigation area that account for two third of the country's and distributed in 80 irrigation districts had been transferred to 316 irrigation associations (Groenfeldt & Sun, 1997; Kay, et al., 1997). Each user association has to ensure the important requirement that is be financially self – sufficient to carry out and cover the cost of O & M and administration.

For each “module” level that is about 5, 000 ha to 20,000 ha, management board is represented by farmers elected every 2 or 3 years, and it hires professional staffs to operate irrigation systems. In term of maintenance, *ANUR* (National Association of Water User) has an agreement in sharing rehabilitation cost with users. The users paid 50 percent of rehabilitation cost and the government would support the other 50 percent (Palacios, 1996). There is a contract between the association and the government irrigation district normally during 20 years period of concession in term of rights and responsibility. The irrigation fees also have to be shared between the association and the government in certain ratios. The result of this reform irrigation management is expressed most obviously in agricultural production. A survey of four transferred districts in 1994 shown 80% of respondents concluded that association management had led to an improvement in agricultural production (Palacios, 1996). Moreover, the farmers also are introduced new technologies like chemical and biological pest control.

However, irrigation associations or modules still had to face some problems in this process. First of all, the lack of fund to cover costs happened frequently. Two – third of

members of boards of directors in surveyed modules in 1994 said their funds, which was based on the water fee, was not enough for O & M and management costs in spite of rising water fee level. The fact that the users could not afford high water charge mean the rate of increase water fee was lower than inflation rate. The shortage of fund leads to lack of machinery to maintain irrigation system. Additionally, poor facilities and equipment phenomenon still exist in many modules. Consequently, water was not provided to meet the need of users and at the times required. Besides, directors of board in several associations lacked of managerial skills and this also caused managerial, financial and operational problem for the modules (Palacios, 1996).

2.4 Evaluation and reassessment of irrigation project

2.4.1 Level of participation and user satisfaction

In general, the success or failure of irrigation project depends on the level of farmer's participation. In order to measure the level of users' participation, normally the project focus on four aspects that are "total membership in the irrigation organization, average attendance at regular and general assembly meetings, member of farmers participating in decision – making and attendance in group work" (Kalshovan, et al., 1989: 37). First of all, membership indicates the degree of the individual involvement in the organization. It only shows the quantity but does not tell the character of participation. Secondly, attendance at meeting shows the concern of users in management of irrigation system and it is a type of social interaction. People can exchange their ideas and opinions as well in the meeting. It also indicates equality and purposeful aim of users as the center of project. Continuously, the decision is synthesized from the different user's opinions in the meeting. They act on behalf of groups of users to express their ideas before action are implemented. Finally, people

attendance in-group work present social interaction and affirms that action is done. It is very important and also decides the level of project's achievements.

With establishment of WUA, the farmer can involve in implementation of O & M activities under the various forms of participation. Then level of user satisfaction is defined as an indication of participation. It can be known in series of O & M activities like water distribution and allocation, actual maintenance and benefits from irrigation (Kalshovan, et al., 1989).

2.4.2 Cost Benefit Analysis

As with many another projects in general and for irrigation project in particular, cost benefit analysis (CBA) is known as an economic tool needed for applying. With any potential investment decision, CBA is considered as a systematic technique mainly utilized to analyze the economic justification. CBA also is regarded as providing a protocol for measuring allocative efficiency that resources like land, labor, and capital are used with the maximum value which under the form of goods and services they create (Boardman, et al., 1996). Furthermore, CBA also provide correct information about the relative efficiency of alternative policies. However, determination and measurement of costs and benefits in CBA is one of the major problems because of the characteristic of costs and benefits that are tangibles and intangibles. In general, tangibles are visible effects, which can be measured into monetary terms. However, intangibles consist of effects that may be quantified but not measured in monetary terms or cannot be either measured or quantified. In agricultural projects, tangible benefits appeared obviously under the form of increased production, quality improvement, change in time of sale, cost reduction through mechanization, reduced transport cost, time savings and so forth. And tangible costs are determined as

reduced net benefits such as physical goods, labor, land, taxes, and debt services. Intangible costs and benefits also can be created in agricultural project like creation of new job opportunities, better health, improve living standard, increased pollution, land degradation (Gittinger, 1982). However, irrigation project in particular affects production clearly in three possibilities. Firstly, the crop may be improved in value. The quality of the crop might be getting better. Secondly, the suitable water control from irrigation project might permit intensification. The farmers can achieve higher yields or harvest a second or third crop each year instead of one or two formerly raised. Thirdly, extensification also can be approached that means new land is brought into production (Southgate, 2000).

After the costs and benefits are determined, it is needed to spread net benefit over the life – span of the project and bring it calculate back to the present value with certain discount rate. Positive net present value (NPV) means the projects is considered profitable and acceptable.

Additionally, sensitivity analysis is also essential to conduct after NPV test. Sensitivity analysis will show NPV tests of the project at the different future relative values of key parameters. These parameters will include:

- (i) The discount rate
- (ii) Physical quantities and qualities of inputs
- (iii) Shadow prices of these inputs
- (iv) Physical quantities and qualities of out puts
- (v) Shadow prices of these outputs
- (vi) Project life span (Hanley, et al, 2001:80)

2.4.3 Structure of benefits – costs distribution

The farmer's role in manage irrigation system is emphasized in various nations in the world. It not only helps to increase irrigated area, crop productivity but also redistribution of costs - benefits in organization or community. It is very obvious that farmer's involvement in irrigation causes reduction in administrative costs of government. That is explained by decreasing number of field staff. Moreover, user's participation contribution under the term of material, capital, and labor in maintaining and rehabilitating irrigation system helps reduce the government costs. Through participation, each participant is more voluntary in managing, protecting system and water fee is charged equally. According to Meinzen - Dick (1997), in 1991 the collection fee for irrigation service in Philippine increased from 45% for non-participatory system to 74% for participatory system. Furthermore, Meinzen – Dick recognized that 22% of irrigation fee decrease was created through participation of farmer in the Columbia Basin. They managed finance themselves, cutting another expenses and finding another funding source.

As water delivery services are improved, water is controlled and used efficiency. Users are really satisfied with these services. Water is distributed equally along the system and even to the head and tail as in Mexico (Lusk & Parlin, 1991). Therefore, everybody can get benefits from both agricultural production and the productivity of the land that is increased under the form of greater crop diversification as well as crop yield. Increase of irrigated area provides more job opportunities for local people and wealth creation as well. Additionally, in developing countries, which accounted for three fourth irrigated areas, food security still is a purpose need to obtain. In order to achieve such goal, irrigation development and rising new land under irrigation need to be implemented widely. These achievements will eliminate poverty rate especially in

agricultural sector and reduce conflicts between users in the community (Fererres & Cena, 1997, Kay et al., 1997).

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the steps and procedures used in data collection and analysis. Data collection was conducted primarily through survey, questionnaire, interviews, observation, and key informant interviews. Secondary data were collected from the relevant department reports, records, newspapers, and Internet website.

3.2 Study Area Profile

B8A secondary canal covers three communes – Thieu Chinh, Thieu Hoa, Thieu Toan. Farming is one of the main occupations of the people in this area. About 90% of planting area is utilized for paddy cultivation. The living standard of people in three communes is still low; where most of them depend heavily on agricultural products. The infrastructure in these communities is still primitive. In term of demography, the total population in three communes is 17, 117 persons within 3,973 households.

3.3 Data collection and Techniques

3.3.1 Identification of Population and Sample

Before the selection of the sample, the population was defined properly. Information collection from the smallholder farmers is the main purpose of this study. Therefore, they are identified as the population. The sample of respondents is selected by using simple random sampling. Simple random sampling is one of the sampling methods that are based on probability. The minimum sample size must ensure adequate population representativeness.

Firstly, initial sample size need to be estimated using the formula below:

$$n = \frac{(\pm 1.96)^2 (p * q)}{S_{p(95)}^2}$$

where,

n = an estimate of required sample size when a 95% confidence level is desired.

(±1.96) = the interval delimiting 95% of the area under a normal distribution's curve.

p = the proportion of survey population responding in a specified way or relative homogeneity of the population.

q= 1 – p

$S_{p(95)}^2$ = the proportion of survey population at the 95% level of population.

Secondly, final sample size (n') is determined as follows:

$$n' = \frac{N * n}{(N + n)}$$

where,

N = the size of the population

n = the initial sample size estimates

n' = the final sample size estimates (Smith, 1986, 223:225).

In this study, the homogeneity of population was estimated to be about 80%, and sampling error was 6%. Therefore, the initial sample size was identified as below:

$$n = (\pm 1.96)^2 (0.8 * 0.2) / (\pm 0.06)^2 = 170.7 = 171$$

However, the population of beneficiaries in 3 communes was about 1079 households.

Therefore, the final sample size was estimated follows:

$$n' = (1079 * 171) / (1079 + 171) = 148 \text{ households.}$$

As a result, 148 required sample households were selected from 3 communes as in Table 3.1 below:

Table 3.1. Targeted number of respondents (sample) by commune.

Commune	No. of Respondents	Percentage
Thieu Chinh	$(570 \times 148) / 1079 = 79$	53.37
Thieu Hoa	$(350 \times 148) / 1079 = 48$	32.43
Thieu Toan	$(155 \times 148) / 1079 = 21$	14.20
Total	148	100

3.3.2 Primary data collection

A total 148 households from three communes were selected as sample population. Both quantitative and qualitative data on WUA actions, the level of communities participation in irrigation system management, economic and socio – economic impacts of this project on the local people were collected. Questionnaires and interviews were used to obtain those information.

3.3.2.1. Interview

Only the heads of households from the study area were interviewed. Interviews were also conducted with the officers from WUA, Chu River IMC and Thieu Hoa IME.

3.3.2.2. Questionnaire

Questionnaire was one of the techniques used in this study. Questionnaires were used to collect for data from the sample households and various authorities. Questionnaires for households provided mainly information about demographic characteristic of respondents, agricultural activities, level of their participation in WUA and environmental aspects of the irrigation system as well. The survey questionnaires included five main sections for 148 households (Appendix D):

- ❖ Section A - General information: This section provides information about the socio - demographic characteristic like age, gender, education attainment and occupation of the respondents.
- ❖ Section B - Agriculture and irrigation management of scheme perspective:
This section deals with the variables relating to the type, agriculture production, water use and irrigation management.
- ❖ Section C - Socio – Economic perspective:
Social – economic factors that includes the present income and expenditure of the household compare to those before. This section is also try to identify the main causes for changing conflicts between users.
- ❖ Section D- Perception of farmer in participation irrigation management:
This section indicates farmer's perception towards B8A WUA's establishment and their participation in irrigation management. It consists of 14 statements to measure their perception with using Likert Scale type as follows:
1= Strong disagree 2 = Disagree 3= Uncertain 4= Agree 5= Strong agree
- ❖ Section E- Environmental perspectives:
The information about the health care, water quality, and other environmental items were collected in this section.

Second type of questionnaire was used for managers of B8A WUA in Thanh Hoa province. The information gathered are mainly about WUA organization and its operation (Appendix E).

The interviews were conducted face-to-face in Vietnamese language between interviewer and locals.

3.3.2.3. Key informant

The more detailed information was obtained interviews with key informants. This method helps the researcher to understand the locals in term of their attitude or behavior with regards to their participation in the project or changes in organization of irrigation system.

The key informant interviewed were focused more on the prominent people such as head and staffs of B8A WUA, Vice Director of Thieu Hoa IME and Vice Director of Chu River IMC and other government officers. By using this technique, it is possible to know more on the various aspects of the impacts of project on communities.

3.3.2.4. Observation

Observation method was also adopted in the study. More information about how the irrigation system management are conducted and managed under WUA and farmers were be collected through observations. This method will help to limit the bias effects on data, which were gathered through interviews.

3.4 Secondary Data Collection

Secondary data were collected from various sources such as libraries, government publications, journal and Internet. For instance, the documents from WUA, Thieu Hoa IME, Chu River IMC provided information between two periods before and after WUA was established in this area such as the amount of the size of the irrigated area, average of productivity, the number of participants, water fees as well as costs to build the irrigation system.

3.5 Contingent Valuation Method (CVM)

Contingent valuation method was used to collect information for measuring environmental damage such as water pollution, loss of fish and vegetation due to construction of the canals. CVM is used widely in developing countries. It plays an important role in the assessment part of externally funded environmental projects. This method was carried out using questionnaires or survey form. People were asked of what are they willing to pay (WTP) for benefits or what are they willing to accept (WTAC) to tolerate costs (Pearce & Turner, 1990). Respondents were chosen randomly from the relevant population who might be farmers or individual from non – farmer groups. The respondent's answers to what are they would be WTP (or WTAC) for a hypothetical increase or decrease in environmental quality are regarded as the most important point for this method. Average WTP or WTAC of the sample is used as a basic to calculate the values of the environmental goods (Hanley, et al., 2001).

3.6 Data Analysis Techniques

3.6.1 Statistic Package for Social Science

The Statistical Package for Social Science software (SPSS) was used to analysis the data and performed some statistical analysis such as:

1. Descriptive Statistic: This tool helps to summarize the data. This statistical analysis summaries the data into frequency and mean results.
 - Frequencies: Frequencies is the one of the simplest and useful procedure. Percentage and cumulative percentage of various subcategories can be easily calculated such as age, occupation, income (George & Mallery, 2003).
 - Mean: The central tendency is rate identified clearly like agriculture production and so on.

2. Inferential Statistic: The inferential statistic used was the correlation analysis shows the relationships between variables. The strength of relationship were known in the forms of Pearson Coefficient (r). The relationship between two variables is getting more significant with the increase in Pearson coefficient. If Pearson coefficient value equal to 0 that means no association between two variables. Whereas, when the r value is 1 it indicates a perfect correlation. Correlation analysis between variables can also indicates the significance of the relationships. A relationship is considered as a significant relationship when p – value is less or equal to 0.5 ($p \leq 0.5$) and not significant if p value is more than 0.5 ($p \geq 0.5$) (Table3.2) .

Table 3.2 The value of Pearson coefficient

Value of Person coefficient	Relationship between variables
0	No correlation
0.1 – 0.2	Very weak correlation
0.3 – 0.4	Weak correlation
0.5 – 0.6	Moderate correlation
0.7 – 0.8	Strong correlation
0.9	Very strong correlation
1	Perfect correlation

Source: Dyer, 1995: 298

3.6.2 Excel Program

Microsoft's Excel Program is a common software used to analyze costs – benefits of a project. The analysis is based on both the primary and secondary data, which were divided into benefits and costs separately. There were several indicators used to analyze costs, benefits and the sensitivity of investment as well such as present value (PV), future value (FV), net present value (NPV), benefit cost ratio (BCR) and Internal Rate of Return (IRR).

3.6.2.1 Present value (PV) and Future value (FV)

Present value is calculated using this formula: $PV = \frac{FV}{(1+r)^t}$

The present value is used to calculate the present worth of a future value at the end of the t th period at the interest of r . In contrast, the future value is used to calculate the future worth of a present amount at the end of the t th period at the interest of r as the formula:

$$FV = PV(1+r)^t$$

where,

PV = Present value

FV = Future value

r = interest rate

t = year t (Gittinger, 1982)

3.6.2.2 Net Present Value (NPV)

Net present value is defined as the result of difference between benefits and costs in the period time of investment. NPV is calculated using the equation below:

$$NPV = \sum_{t=1}^T \frac{B_t - C_t}{(1+r)^t}$$

where,

NPV = Net Present Value

B_t = benefit in year t

C_t = cost in year t

T = life – span of the project

t = 1, ..., T

The project is accepted for implementation if NPV value is greater than zero.

3.6.2.3 Net Social benefits

Net social benefit is the total of net private benefits and net public benefits. Net social benefit indicates the real value of the project. It is so because not only the economic but the environmental aspects at the project are also included in the evaluation. Net private benefit is derived by subtracting private costs from private benefits. Similarly, net public benefit also is depicted as the difference between public benefits and costs. The net social benefit is calculated by using the formula below:

$$\text{Net Social Benefit} = \sum_{l=1}^n (\text{Pr} B - \text{Pr} C) + \sum_{k=1}^m (\text{Pu} B - \text{Pu} C)$$

where,

PrB = total private benefits

PrC = total private costs

PuB = total public benefits

PuC = total public costs

l = related private activities (1,...,n)

k = related social activities (1,...,m)

3.6.2.4 Benefit – Cost Ratio (BCR)

Benefit – cost ratio is also used to assess the worth of a project. Benefit – cost ratio is obtained by dividing the present worth of the benefits stream with the present worth of the costs stream. The project is regarded positive or beneficial when this ratio is greater than 1 (Gittinger, 1982). BCR is calculated using the equation below:

$$BCR = \frac{\sum_{t=1}^T \frac{B_t}{(1+r)^t}}{\sum_{t=1}^T \frac{C_t}{(1+r)^t}}$$

3.6.2.5 Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is defined as the rate of discount that makes the present value of the total benefits equal the present value of the total cost. The IRR is the discount rate which makes the present value of the entire stream of benefits and costs is exactly equal to zero (Mishan, 1988). It is also the maximum interest that the project could assume to ensure cost payment. Therefore, IRR is a very useful criteria to determine the worth of a project and also its earning rate.

CHAPTER 4

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the results, which include both quantitative and qualitative findings related to socio – demographic characteristics, legal institution and framework of the B8A WUA, farmer’s participation, cost – benefit analysis of the project and the socio – economic impacts of the project, since the establishment of B8A WUA. Statistical Package for Social Science (SPSS) and Excel software have been used to analyze these data.

4.2 Socio – Demographic Characteristic of Respondents

4.2.1 Population structure and dynamic

4.2.1.1 Gender

Most of the respondents interviewed were males which account for 83.1% (123 persons) out of 148 households, while the other 25 (16.9%) were females. This result affirms the perception on the role of men as the head of households, especially in the rural areas in Viet Nam is mostly correct. The fact that the women respondents interviewed were basically representing their husbands who were out for work during the study period.

4.2.1.2 Age Profile

Table 4.1 Frequency and percentage of respondents by age group (n =148)

Age	Frequency	Percentage (%)
20-29	2	1.35
30-39	42	28.37
40-49	68	45.94
50-59	21	14.18
60-69	12	8.10
70-79	3	2.06
Total	148	100

The majority of respondents in the three studied communes (45.94%) were in the age group of 40 to 49 year-old (Table 4.1). A significant proportion of respondents (28.37%), were of the age between 30 to 39- year- old. About, 21 (14.18%) respondents were in the 50 to 59- year- old category, the other 12 (8.10%) were between 60 to 69 year- old. Those in the age groups at 70 to 79- year- old and the 20 to 29- year- old represented 3.41% of the respondents. The average age of respondents was 44 years old. It is known that the life expectancy in this area is not really high. The number of young respondents was low might be caused by out – migration for other employments of the studied communes.

4.2.1.3 Occupation

The main purpose of this study is to asses the role of farmer’s participation in managing an irrigation system. It was found that most of the household heads were farmers (90.5%), while the others (9.5%) considered farming as a second job. The rest of them were laborers, government servants and even pensioners.

4.2.1.4 Education

The level of education attained by the respondents was generally not high (Figure 4.1). Most of them (67.6%) have completed their secondary school, and 29 (19.6 %) of them have high school education. About 11 (7.4%) of the respondents have primary education while the rest seven (4.7%) persons of them have no formal education. There was only one person who has attained college level education (0.7%).

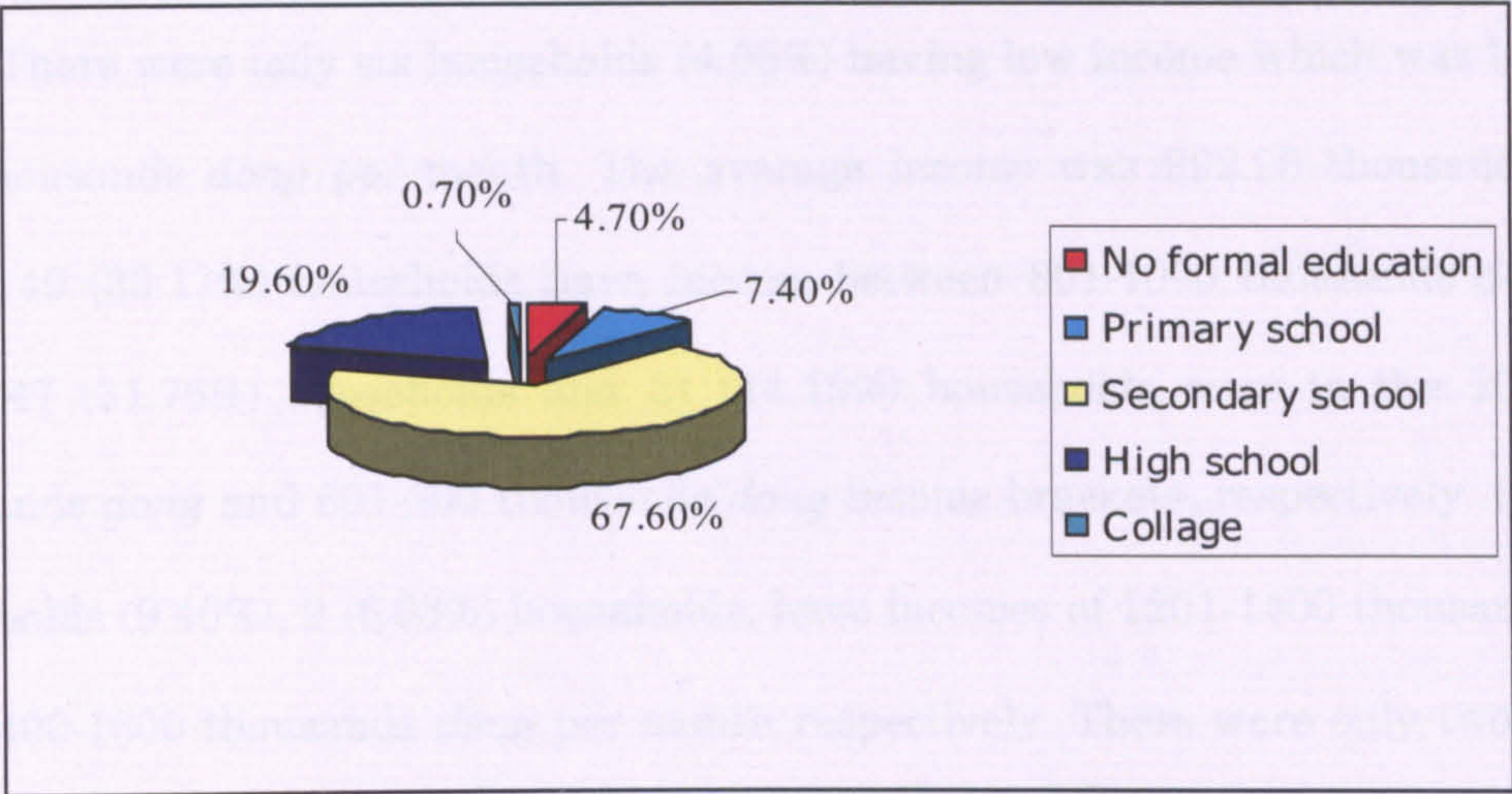


Figure 4.1 Education levels of respondents

4.2.1.5 Household size

Table 4.2 Frequency and percentage of respondents by the category of family size

Family size Category	Number of households	Percentage (%)
2-3	17	11.5
4-5	119	80.5
6-7	12	8.1
Total	148	100

(Arithmetic Mean = 4.3 person per household)

The average household size was four persons (Table 4.2). The most common family size was of four to five persons that accounted for 80.5% of the households. About 11.5% of

the households were in the household size of two to three person category. There were only 12 (8.1%) of households having six to seven persons per household. Generally, the family size of the family in the study area was considered small compared with the others rural areas in Vietnam.

4.2.1.6 Household Income and Expenditure

The household’s income is tabulated in the Table 4.3 below. The monthly income ranges from as low as below 600 thousands *dong* to as high as above 1,601 thousands *dong*. There were only six households (4.05%) having low income which was less than 600 thousands *dong* per month. The average income was 992.95 thousands *dong*. About 49 (33.11%) households have income between 801-1000 thousands *dong*, the other 47 (31.76%) households and 21 (14.19%) households were in the 1001-1200 thousands *dong* and 601-800 thousands *dong* income brackets, respectively. Fourteen households (9.46%), 9 (6.08%) households, have incomes of 1201-1400 thousands *dong* and 1400-1600 thousands *dong* per month respectively. There were only two (1.35%) household whose income was above 1,601 thousands *dong*. It can be concluded that most of the households have income between 800 – 1200 thousands *dong* per month.

Table 4.3 Frequency and percentage of household by income class

Income level class (Thousands dong)	Frequency	Percentage (%)
Less 600	6	4.05
601-800	21	14.19
801-1000	49	33.11
1001-1200	47	31.76
1201-1400	14	9.46
1401-1600	9	6.08
Above 1601	2	1.35
Total	148	100

(Arithmetic mean income = 992.95 thousands dong per household)

According to the Ministry of Labor and Social Affairs, the Poverty Line Income (PLI) for whole rural area in Vietnam in the delta region is 100 thousands *dong* per person per month (Ministry of Labor and Social Affairs, 2000). Therefore, there is no interviewed household whose income below the PLI in this area.

It obvious that the most important source of income from rice, which accounts for 521 thousands *dong* (52.47%) out of the average household income of 992.95 thousands *dong*. Secondly, raising cattle and poultry are considered among the main sources of income that contributes an average of 220.98 thousands *dong* per family, where a total of 148 households are involved. Other, incomes include from rice and livestock, incomes from small business and salaried employments also help to improve the overall household income. It was found that the current mean income has increased by about 336 thousands *dong* per month compare to the average household income before 1998.

The monthly average household expenditure is 761 thousands *dong*. The increase in the average household income has caused people to spend more. A positive and very strong relationship between income and expenditure levels is observed when a correlation test was performed for these two variables ($r= 0.860$, $p<0.01$). That means the higher the income level of the household result in higher household expenditure.

Table 4.4 Result of Pearson Correlations between average income and expenditure (n=148)

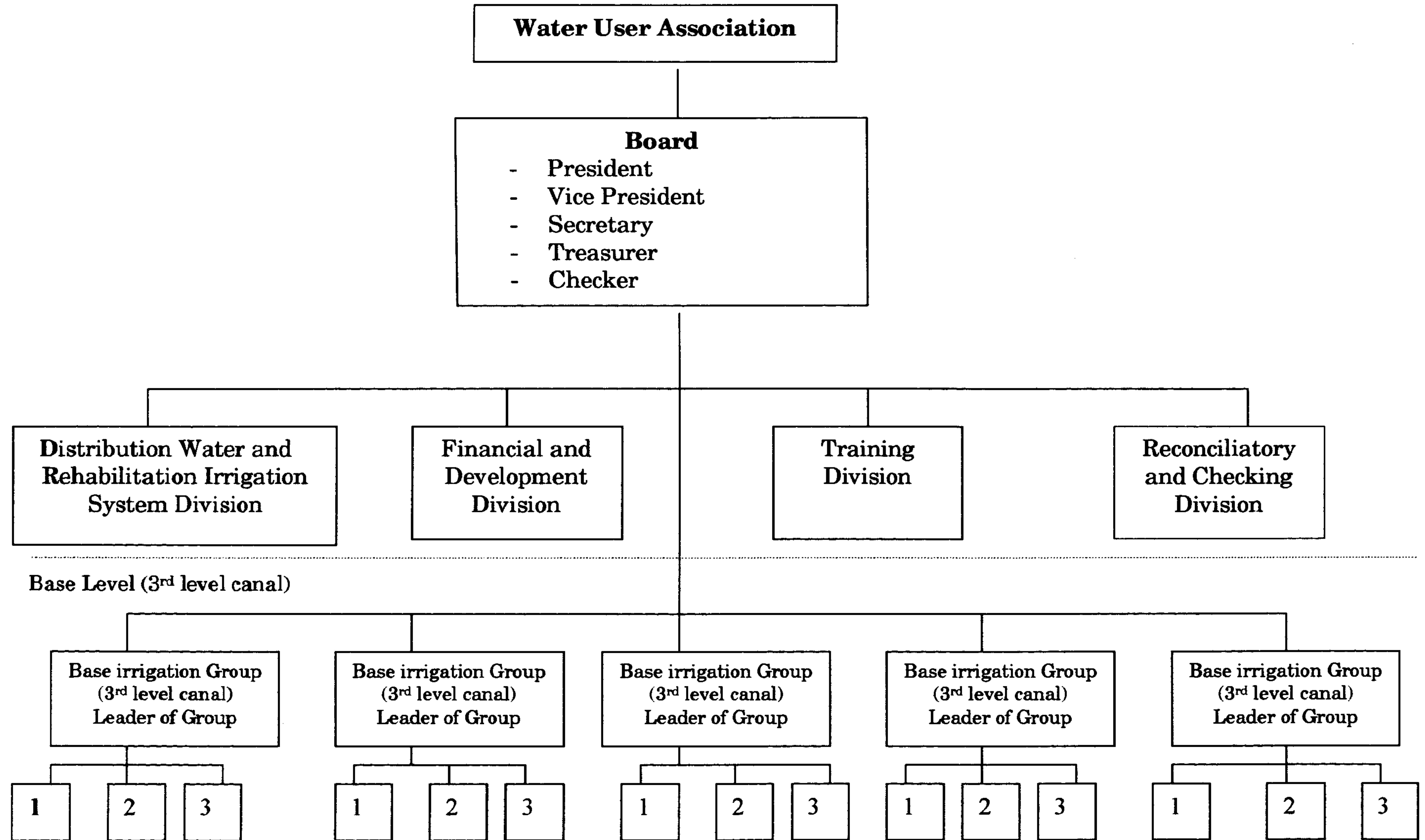
		Average income per month (thousand dong)	Average expenditure/month
Average income per month (thousand dong)	Pearson Correlation	1	.860**
	Sig. (2-tailed)	.	.000
	N	168	168
Average expenditure/month	Pearson Correlation	.860 **	1
	Sig. (2-tailed)	.000	.
	N	148	148

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

4.3 Legal institution and framework of the B8A WUA

WUA is a water economic organization model that created because of the farmer’s requirements in order to obtain higher productivity, protect and manage irrigation works in a stable manner with the aim of total development of the agricultural sector. As mentioned earlier, B8A WUA was set up in 1998. It is still depending on the Thieu Hoa Irrigation Management Enterprise and Chu River Irrigation Management Company for professional and technical assistance. WUA is empowered with all fixed assets that include the whole irrigation systems of three communes by People’s Committee. B8A WUA is operated based on the fair principle that everybody has benefits equally from water resource and policies are applied strictly. Therefore, the main purpose of B8A WUA establishment is to ensure enough water to the users. Most of the participants in the project are farmers from the three communes Thieu Hoa, Thieu Chinh and Thieu Toan whose are within the irrigated land border. Volunteers are also involved in the project by contributing cash and providing labor to manage and rehabilitate irrigation system.

WUA has rights to decide on organizational structure, employing people and receiving capital from other organizations. B8AWUA, however, has to take care of irrigation system so that it can be exploited or rehabilitated efficiently. Water fees must also be returned to the government under the 112 *HDBT* Decree and 1054 Decision of Thanh Hoa Province's People's Committee (B8A WUA File, 1998). The structure of B8A WUA is as described in Figure 4.2.



Note: 1- Sub Distribution Water and Rehabilitation Irrigation System Board

2- Sub Water fee collection Board

3- Water User

Figure 4. 2 B8A Water User Association's Organization Structure

The WUA board of management consists of head of WUA, his deputy, an administrator and a supervisor. WUA also has an accountant and a cashier who are elected in the plenary meeting. Board of WUA appraises the financial aspects of its as well as solving the conflicts between users. The main role of head of WUA is oversee the overall operation of WUA. He is assisted by a deputy who is managing operations and maintenance of irrigation facilities. Under the Board of management, there are four specialty divisions, which are working together to help the head of WUA to ensure the efficiency of the irrigation system. First of all, Distribution Water Rehabilitation Irrigation System Division who is responsible for delivery of the water to each irrigation group. Next is the Financial and Development Division who is responsible in managing WUA's financial budget and collecting water usage charges from users and pay for the WUA's operation costs. Then the Training Division whose main function is to guide and teach farmer the techniques to use water in an efficient manner as well as protecting the irrigation system. Finally, the Reconciliatory and Checking Division also checks all WUA operations and also receive and solve complaint from the users.

In order to manage water distribution from main canal to the fields, there are also irrigation groups with their members are called irrigators. Each irrigation group has different tasks like water fee collection, rehabilitation and supplying water. Each irrigation group after receiving water from the administrator is responsible for delivery of water to the farmers' fields. Every season and every year, based on the production plans of different groups, the WUA has established and developed water allocation schedules. Contracts are then signed with each group and water fees will be collected based on the contract and the actual performance. The members of WUA's organization are elected again every three years by users.

4.4 Farmer's Participation in Irrigation Management

4.4.1 Types of participation

Most of the users who participate in managing the irrigation system are farmers with high demand for water usage. When WUA was established in 1998, there were about 756 users in the three communes. Up to now, the number of users has reached to 1079 members. All of the respondents interviewed claimed, that they are really participate in B8A WUA. Generally, most of them (98.6%) participate as members who actively use irrigation water. The others join WUA not only as members who use water but also working as committee member of WUA. These committee members are farmers and elected by users from each commune. There are 27 irrigators who are responsible in water distribution for three communes, representing users in managing and ensuring that the WUA's operations are carried out clearly and efficiently. The participants also contribute water fee sufficiently, which is determined through Decision of People's Committee. Furthermore, in order to carry out concretization of more extensive field channel systems with the Government's assistance, farmers are encouraged to contribute 240 thousands *dong* per hectare per year. Water fee administration is announced publicly in meetings between users (Nguyen, personal report, 25 January, 2005). This study found that most of the respondents (66.2%) knew and participated in the management of water fee. However, the B8A's Board members will decide on water fee distribution based on its policies and also the user's opinions. Users were participated in both planning and implementation processes like findings of Raby in Philippine case (Raby, 1997). Out of 148 respondents, 50 (33.78%) of them are involved with engineering design of canals and 96 (64.86%) of them are involved in construction works. All of them, however, participated in the maintenance works through full water fee contribution. They are also cooperate with the Government in the management of irrigation system in several ways such as cash and labor

contributions. Out of 148 respondents interviewed, 79 (53.4%) of them have contribute labor, while 44 (29.73%) persons donated cash to the WUA (Table 4. 5).

Table 4. 5 Community participation in the planning and implementing of the process

Activity/ Function	Frequency	Percentage
Net work design involvement	50	33.78
Construction involvement	96	64.86
Water distribution involvement	6	4.05
Water use policy	146	98.65
Fee administration	98	66.2
Maintenance of system	148	100
Labor contribution	79	55.37
Cash contribution	44	29.73
Meeting		
One time per year	100	67.56
Two times per year	48	32.44

Users are actively involved in WUA's regular meetings where they can voice and discuss their ideas. Through the dialogue, between managers and users, the managers can understand users' requirements clearly and thus able to formulate an opened and balanced the WUA policy. Majority of respondents (98.65%) said that they do participated in water user policy establishment. Hence, out of 148 respondents, 126 (85.1%) of them agreed and 14.9 % strongly agreed that all participants have the same rights in WUA in managing irrigation schemes. WUA's regulations are established through discussions in meetings between members before submitting for approval from the Chairman of Thieu Hoa District People's Committee.

Meeting is conducted two times per year and requires at least two-third of members' attendance. About 100 (67.56%) respondents admitted attending all B8A WUA's meetings, that is two times per year while 48 (32.44%) of them attended only once.

Generally, the users' awareness of their roles in the meetings and their involvement in the management of irrigation system is very essential to the success of the project.

Users who are involved in activities and functions of WUA are from at all age levels. Pearson correlation was used to determine the relationship between age and various WUA's activities in the planning and implementation process. At the level of 0.05, the results in Table 4.6 indicated an insignificant correlation between the two these variables. Therefore, the age of a respondent not affect his/her involvement in WUA's activities.

The result of the test indicated that there is an insignificant correlation between the planning and implementation of the process and the age of the respondents (weighted $r = 0.314$, $p = 0.637$). Therefore, the null hypothesis which stated that there is a significant relationship between age and the participation of water users in various activities and functions of the WUA is rejected.

Table 4. 6 Results of Person Correlation between respondent age and participation in WUA

Type of activities (function)	Age	
	Pearson Correlation (r)	Sig. (2-tailed) (p)
Construction involvement	0.18	0.828
Water distribution involvement	0.61	0.461
Water use policy	-0.22	0.786
Fee administration	0.36	0.666
Position in WUA	0.64	0.442
Weighted	0.314	0.637

4.4.2 Perception of water users towards B8A WUA's establishment

Thieu Hoa district is the first districts to carry out managed irrigation system with farmer's participation in Thanh Hoa province. Although the project has been

implemented for only seven years, most of users recognized that the roles of farmers and the government are very important in managing and protecting the irrigation schemes. The perceptions of the users on B8A WUA's is described in Table 4.7

Table 4.7 Summary of scores for statement on respondent's perception towards B8A WUA's establishment

Respondent's perception towards B8A WUA's establishment		Frequency*				
		1	2	3	4	5
1.	The irrigation system is for farmer/community	0	0	0	59 (39.9)	89 (60.1)
2.	Farmer participated to design, investigate irrigation system	0	0	12 (8.1)	119 (80.4)	17 (11.5)
3.	The level of water fee is suitable	0	6 (4)	3 (2.1)	133 (89.9)	6 (4)
4.	Productivity of rice in your family increases from this irrigation system	0	0	0	135 (91.2)	13 (8.8)
5.	Your family's income is increased through this irrigation system	0	5 (3.4)	4 (2.7)	120 (81.1)	19 (12.8)
6.	Your family's jobs are diversified from this irrigation	0	11 (7.4)	22 (14.9)	104 (70.3)	11 (7.4)
7.	WUA helps community closer together	0	0	0	73 (49.3)	75 (50.7)
8.	WUA ensures equality between users	0	0	0	70 (47.3)	78 (52.7)
9.	The knowledge of protection of water resources as well as agriculture increased through PIM	0	0	0	83 (56.1)	65 (43.9)
10.	The combination between government and WUAs / community in PIM lead to higher irrigated efficiency	0	0	0	131 (88.5)	17 (11.5)
11.	The role of farmer's participation in managing irrigation system (IS) is very important.	0	0	0	133 (89.9)	15 (10.1)
12.	All participators have the same rights in B8A WUA in managing IS	0	0	0	126 (85.1)	22 (14.9)
13.	The opportunities of job has been increasing for 3 communes though this project.	0	2 (1.4)	4 (2.7)	122 (82.4)	20 (13.5)
14.	You are satisfied with B8A WUA	0	0	0	89 (60.1)	59 (39.9)

Note:

1- Strongly disagree

2 - Disagree

3- Uncertain

4- Agree

5- Strongly agree

*: Number in frequency and percentage

The results of the survey are as follows:

- a) About 89 (60.1%) respondents strongly agreed and 59 (39.9%) persons agreed that the irrigation system is for farmers and the community. None of them disagreed. Farmers have the responsibilities to decide how to use and protect irrigation systems efficiently with government's assistance, which are mainly in the form of technical supports.
- b) Most of respondents (80.4%) agreed and 17 (11.5%) persons strongly agreed that farmers participated in the designing and the evaluation of the irrigation system. Only 12 (8.1%) persons were uncertain about this statement.
- c) On the issue of water fee, the majority of respondents believed that the water fee level is suitable. Six of them (4.1%) strongly agreed, while 3 (2%) persons were not sure. Another, 6 (4.1%) of the respondents were disagreed on this idea.
- d) From the total of 148 respondents, 91.2% agreed and 8.8% strongly agreed that their productivity has increased by the new irrigation system. Therefore, 120 (81.1%) agreed and 19 (12.8%) respondents strongly agreed that their family's income has increased compared with those before 1998. However, four persons were uncertain and five respondents disagreed on this statement because their income is mainly from business activities.
- e) In term of job diversification, most of the respondents (70.3%) agreed, and 7.4% strongly agreed that this project helps to increase job opportunities. Job diversification is not only includes the increasing number of jobs but also encompass a range of work types. Nonetheless, 22 (14.9%) persons and 11 (7.4%) of them were not sure and disagreed with the idea, respectively.

- f) There were about 50.7% and 49.3% of the respondents who were strongly agreed and agreed respectively that WUA helps community to be closer together. This result is expressed by 70 (47.3%) of them who agreed and 78 (52.7%) respondents strongly agreed that water is distributed equally between users.
- g) More than half of respondents (56.08%) agreed and 65 (43.92%) of them strongly agreed that participation in irrigation management helps them improved the knowledge on water resources protection and agricultural development.
- h) The combination of efforts between the government and WUA in irrigation management are highly praised. Majority of the respondents (88.5%) agreed and 11.5% concluded that the combination of efforts leads to bigger area of irrigated land. The role of farmer's participation also mentioned in this project. Out of 148 respondents, 133 (89.9%) of them agreed and 15 (10.1%) strongly agreed that farmers play an important role in the managing irrigation system together with the government. All of them believed that participants have the same rights in B8A WUA in managing irrigation system.
- i) In addition, 122 (82.4%) respondents agreed and 20 (13.5%) of them strongly agreed that the job opportunities have been increasing in the three communes through this project. Whereas, 2 (1.4%) of the respondents disagreed and 2.7% was uncertain about the idea.
- j) Finally, it is very interesting to find out that 89 (60.1%) respondents agreed and 59 (39.9%) of them strongly agreed that they are satisfy with B8A WUA's operation and management.

Previously, the irrigation schemes which belong to the government and farmers was seen to rely fully on the government to maintain, rehabilitate and protect irrigation facilities through irrigation stations. When the irrigation schemes were deteriorated, they would call the government to repair them. Now, their perception has been totally changed. Most of respondents agreed that the irrigation systems are for farmers and they have the responsibilities to decide on how to use and protect or maintain the irrigation system with the government's assistance, which is mainly in the form of technical supports. They are now contributing money and labors for the repairing or maintaining of the systems without waiting for the government whenever anything happen to their irrigation schemes. The establishment of B8A WUA has created a new management method for irrigation system. This project also helps farmers to improve their life and knowledge in managing water resources. Moreover, the close working relationships between users in the different communes have reduced the conflicts significantly.

4.5 Cost - Benefit Analysis

4.5.1 Benefits

Private Benefits

Private benefits of the project are mostly from water fees that are fixed by Thieu Hoa People's Committee at the different levels at different times. Furthermore, private benefits also include 2% of the water fee given by the government to WUA (Table 1e - Appendix A).

Public Benefits

Direct public benefits to individual households are measured in term of increased agricultural production, reduction in the terminal value of the project, the reduction in

flood damage and the management costs. The assumptions on the intermediate data and summaries related to measurement of these benefits are given in Table 2a, Appendix A.

Indirect benefits are not directly convertible to monetary term. For example the concreted canals that provide a series of intangible benefits that reduced food scarcity, water borne diseases and increased irrigation efficiency. These benefits are also assumed and estimated as the Table 2b, Appendix A.

Values used in all calculation are converted the values in the year 2004 for consistencies. Value of the project before and after 2004 must be converted to the values in the year 2004 by using present and future value.

4.5.2 Costs

Private costs

Private costs consist of all construction costs of 4km B8A secondary canal and B2-8A and B4- 8A tertiary canal. Moreover, operation and maintain costs, water collection fee, salary for WUA staffs, purchasing office equipments, returned water fee for Chu River IMC and water fee reduction because of natural disasters also are counted in private costs (Table 3a, Appendix B).

Public costs

Public costs are regarded as all costs that the public has to pay whether direct or indirectly. In this study, direct public costs are the cost of office that WUA borrow from Thieu Chinh People's Community, the North Canal construction costs, the Quy Xa sluice rehabilitation costs, and the contributions of users in form of labor and cash as

well as salary for the engineering works from Thieu Hoa Irrigation Management Enterprise and irrigators. Another public costs are the environmental costs which include the value of fruit trees cut down when canals were built and the loss of fish due to canal concretion (Table 3b, Appendix B). The environmental values were collected using Contingent Value Method.

Net Social benefits

The project is implemented at 10 percent discount rate with 30 years life – span. The total net social benefits is 1671.87 millions *dong* Therefore, the project is considered positive for both private and public side (Appendix F3).

4.5.3 Cost – Benefit Analysis

From the secondary data and interviewed respondents, cost benefit analysis of the irrigation project is calculated. Main purpose of cost benefit analysis is to assess the efficiency of both WUA establishment and concreted canals toward users in three communes in economic terms.

Sensitivity analysis (project scenario 1) is used in this project in order to compare the return of investment with the discount rates of 8%, 9%, 10%, 11% and 12 %. At the 8% discount rate, the present value of social benefits was 33808.59 millions *dong* and the present value of social costs was 28350.55 million *dong*. The present values of the social benefits and costs at the different discount rates are also shown in Table 4.8.

Table 4. 8 Benefit – Cost Analysis of the irrigation project

<div>Scenario \ r (%)</div>	8%	9%	10%	11%	12%
Project Scenario 1					
PBV (Md)	33808.59	32565.26	31530.95	30679.01	29987.14
PCV (Md)	28350.55	29041.25	29859.08	30798.48	31855.40
NPV (Md)	5458.05	3524.02	1671.87	-119.47	-1868.26
BCR	1.19	1.12	1.06	0.99	0.94
IRR (%)	13	13	13	13	13
Project Scenario 2					
PBV (Md)	36005.51	34272.38	32861.27	31718.60	30801.77
PCV (Md)	29214.02	29715.58	30387.24	31213.33	32182.17
NPV (Md)	6791.49	4556.80	2474.03	505.27	-1380.40
BCR	1.23	1.15	1.08	1.02	0.96
IRR (%)	13	13	13	13	13
Project Scenario 3					
PBV (Md)	35322.14	33742.15	32448.61	31396.50	30549.62
PCV (Md)	29222.55	29722.28	30392.52	31217.51	32185.48
NPV (Md)	6099.59	4019.86	2056.09	178.99	-1635.85
BCR	1.21	1.14	1.07	1.01	0.95
IRR (%)	13	13	13	13	13
Project Scenario 4					
PBV (Md)	31905.34	30990.63	30225.87	29595.45	29085.96
PCV (Md)	27591.79	28409.39	29331.93	30357.89	31486.51
NPV (Md)	4313.55	2581.24	893.94	-762.44	-2400.55
BCR	1.16	1.09	1.03	0.97	0.92
IRR (%)	12	12	12	12	12

- Note:
- + Project Scenario 1: Sensitivity analysis with the different discount rates from 8% to 12%.
 - + Project Scenario 2: Assume the life span of the project is 40 years and in the end of the project, the terminal value is only 25% of the canal construction costs.
 - + Project Scenario 3: Assume the life span of the project is 40 years and the terminal value is about 25% of the canal construction costs. The increase of agricultural production still keep as same as assumptions of the original project until 2025. But it will increase only 40% of 2123.4 millions *dong* (2.1.1, Appendix A) per year from 2026 to 2030 and 25% from 2031 to 2035. Moreover, the maintain costs will increase 50% from 2025 to 2035 because of degraded irrigation system.
 - + Project Scenario 4: Assume the long span of the project is 25 years and the terminal value is 60% of the construction cost in 2020.

r : Discount rate

PBV : Present Benefit Value

NPV: Net Present Value

IRR: Internal Rate of Return

PCV : Present Cost Value

BCR: Benefit/Cost Ratio

Md: Million *dong*

It is recognized that the results of the original project are very sensitive to the discount rates. At 8 %, 9% and 10% discount rates NPV is positive, but it is negative at higher discount rates of 11% and above. These results can be explained by the additional heavy construction costs for both main North canal and secondary B8A schemes. At 8% discount rate, NPV is the highest at 5458.05 millions *dong* compare with 3524.02 and 1671.87 millions *dong* at 9% and 10% discount rate, respectively. It is very important to analyze the IRR and BCR because they reflect the benefits of the project at the different discount rates. Normally, the higher the discount rate is the smaller the resultant benefit- cost ratio. As can be seen that the BCR is the highest (1.19) at the lowest discount rate (8%) with 1.12, 1.06, 0.99 and 0.94 at the 9%, 10%, 11% and 12%, respectively. It can be concluded as that the original project will not be beneficial at the discount rates above 11% because its BCR will be less than 1. The IRR for the original project was 13% (Appendix F1 – F5).

By comparing the original project plan and the scenarios. It was found that, at the all levels of discount rate, the second project scenario is considered the most efficient project because it has the highest NPV and BCR. B8A secondary schemes are still benefiting even in the case of the project life span is 40 years, terminal value is 25% of the construction costs and another costs still keep the same as the original project until the end of the project (Appendix G1 – G5). The third project scenario, is still considered to be more efficient than the original project because of the higher NPV and BCR (Appendix H1 – H5). It is very interesting to note that the second and third project scenario are still efficient at the discount rate of 11% compare with the original project at this discount rate. With lower NPV and BCR compare with the original project, the fourth scenario is considered not efficient as expected because of its negative NPV at 11% and 12% discount rate, and the NPV is also less than of the

original project at 10% (Appendix I1 – I5). Furthermore, when the IRRs of the second and third scenarios are 13%, the IRRs of the last scenario is 12%. In conclusion, the project is considered efficient at the discount rate of 8%, 9% and 10% because the perceived social benefits can still cover the social costs as shown by the positive BCRs. In contrast, it is rejected and considered inefficient at the discount rate of 11% and 12%. Moreover, the project is still can be benefited with a longer project's life span as the purpose of the project is related to more social benefits than the business benefits.

4.6 B8A WUA's establishment impacts Socio- Economic aspects

4.6.1 Agriculture production

In general, the farm size in the studied area is small ranging from 0.05 hectare to 0.5 hectare. Most of the land is used for paddy plantation during two the main seasons, i.e. autumn-summer and spring-winter seasons. During winter, maize and vegetables are planted in the certain areas. The mean size of the cultivated land is 0.29 hectare.

Since WUA was established, the productivity of paddy in three communes has increased significantly. All of respondents concluded that the total agricultural production is more than that of before 1998, which increased on the average of 3,282 thousands *dong* per year. The yield of paddy in 2004 was 5.84 tons per hectare per year, compare with 4.37 tons before 1998. Therefore, the yield of paddy per hectare in 2004 was 33.6% higher than the yields before 1998. According to the statistics of Thanh Hoa province, the productivity of paddy of the province and Thieu Hoa district before 1998 was 3.8 tons and 4.74 tons per hectare per year respectively (Table4.9). By comparing the yields of paddy before 1998 with current yield in Thieu Hoa's district and Thanh Hoa's province, it was found that the productivity of the paddy in the study

area in 2004 was 5.3% and 30.4% higher respectively. So far, the difference in yield of paddy between the study area, Thieu Hoa district and Thanh Hoa province, has been reduced. Although the estimated yield of paddy is less than in Thieu Hoa district's (2.82% lower) it is still higher compare with those of Thanh Hoa province by 12.09%. This is explained by the increase of government's investments in agricultural works and technical assistance in Thanh Hoa province.

Table 4.9 Yield of paddy in study area, Thieu Hoa district, Thanh Hoa province

Study area (ton/ha)		Thieu Hoa district (ton/ha)		Thanh Hoa province (ton/ha)		Compare with Thieu Hoa's productivity (%)		Compare with Thanh Hoa's productivity (%)	
Before 1998	2004	Before 1998	2004 (estimated)	Before 1998	2004 (estimated)	Before 1998	2004 (estimated)	Before 1998	2004 (estimated)
4.37	5.84	4.15	6.01	3.35	5.21	+ 5.3	- 2.82	+30.4	+12.09

Source: Statistical Yearbook, 2000: pg 60-61 & 2004: pg 57-58

From the available information, it is clear that agricultural productivity has been increasing since 1998. As of today, the average production in the three communes is at 6.2 tons per hectare per year. This level of production is assumed to be sustained with the implementation of the project (Figure 4.3).

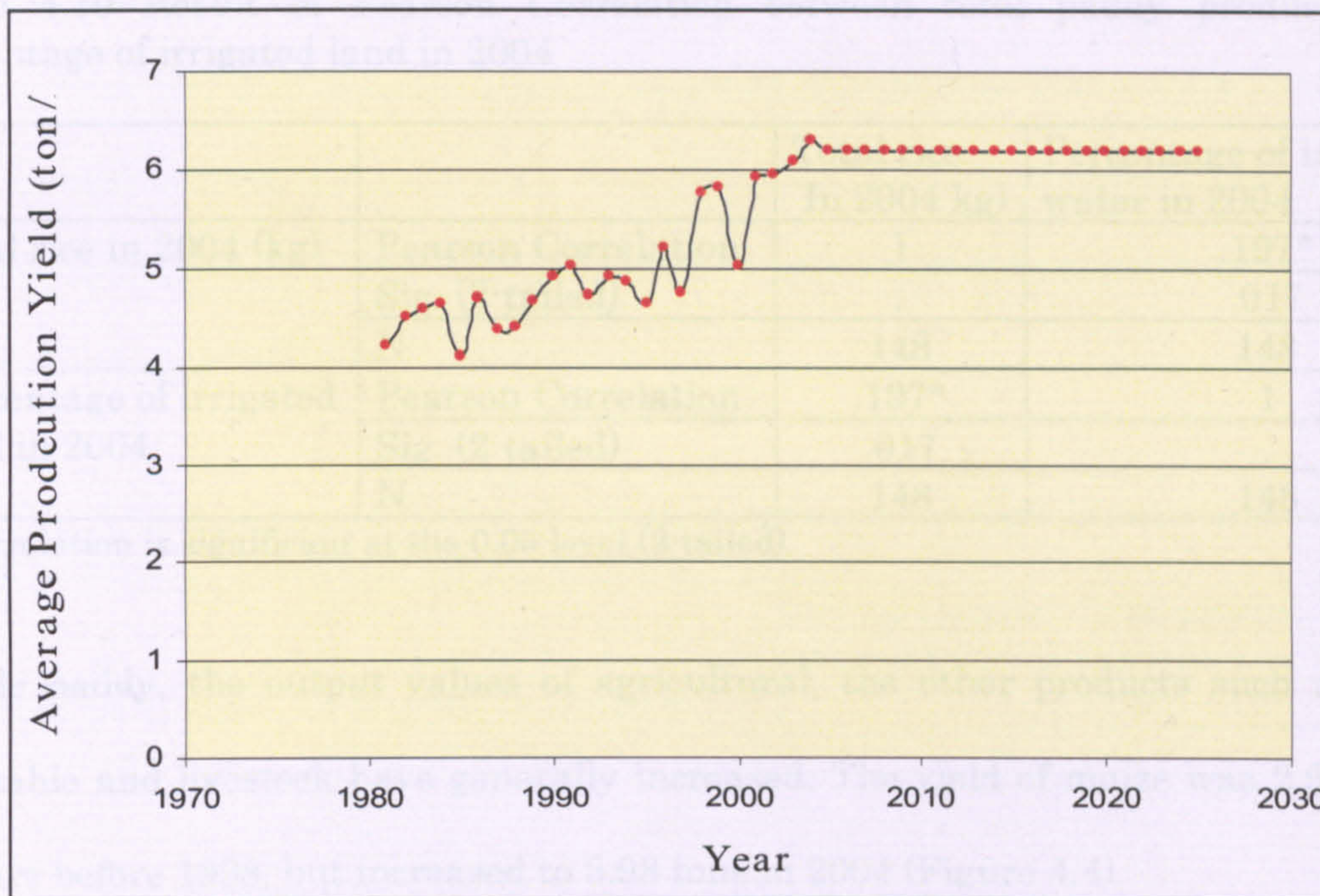


Figure 4.3 Trend of average production yield from 1981 to 2025 in three communes
Source: Thieu Hoa Statistical Office & Thieu Hoa Irrigation Management Enterprise, 2005

The total increase in paddy production is correlated with the percentage of irrigated water. Table 4.10 reveals the findings of the correlation analysis between two variables. The result indicates that there is a significant ($r = 0.197$, $p = 0.019$) though correlation between total paddy production and percentage of irrigated land. This indicates water supply plays an important role in contributing the total paddy production. Therefore, the null hypothesis which stated that there is a significant relationship between the total paddy production and the percentage of irrigated land is accepted.

Table 4.10 Result of Pearson Correlation between total paddy production and percentage of irrigated land in 2004

		Total rice In 2004 kg)	Percentage of irrigated water in 2004
Total rice in 2004 (kg)	Pearson Correlation	1	.197*
	Sig. (2-tailed)	.	.017
	N	148	148
Percentage of irrigated land in 2004	Pearson Correlation	.197*	1
	Sig. (2-tailed)	.017	.
	N	148	148

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

Beside paddy, the output values of agricultural, the other products such as maize, vegetable and livestock have generally increased. The yield of maize was 2.9 tons per hectare before 1998, but increased to 3.98 tons in 2004 (Figure 4.4)

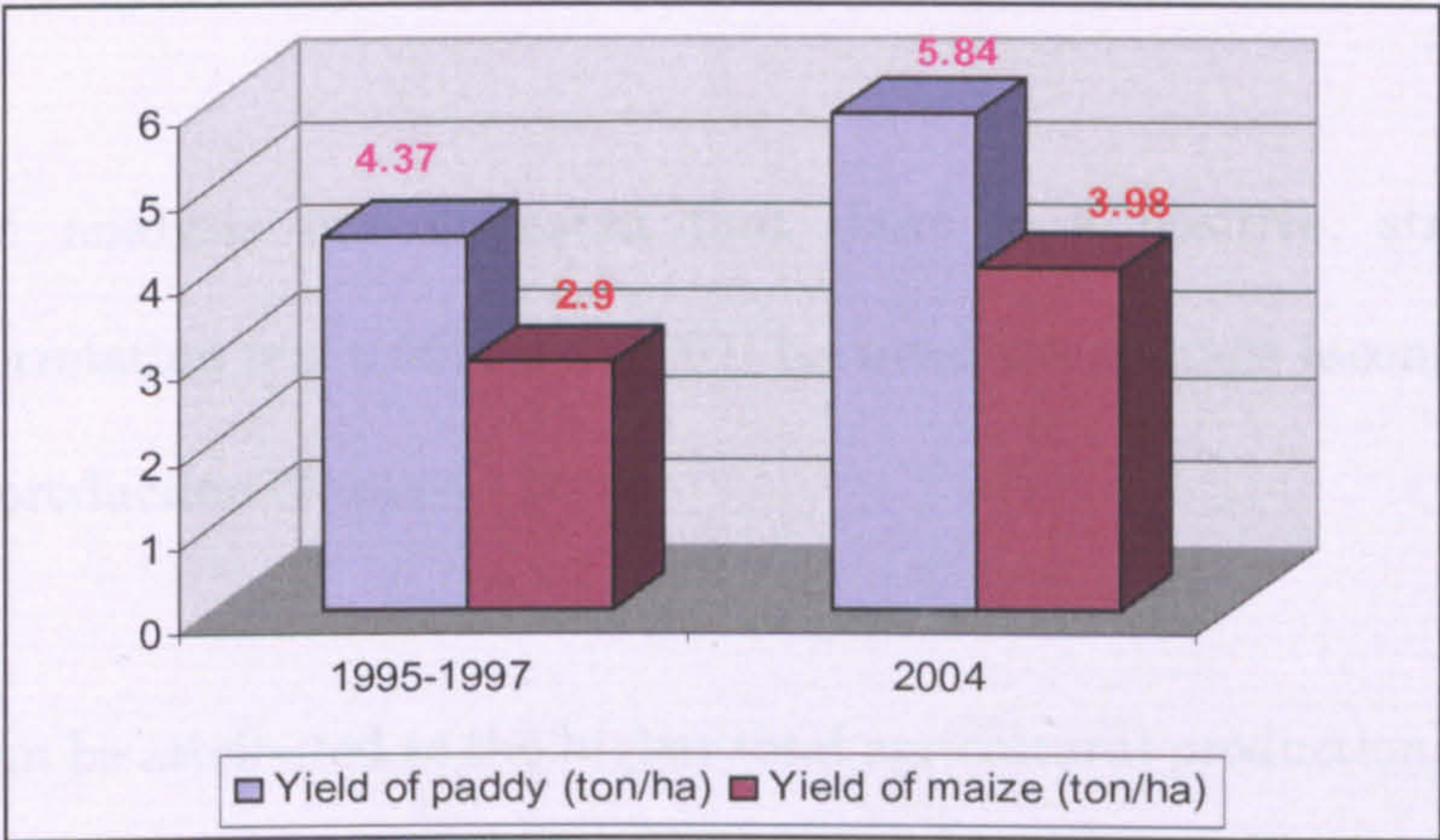


Figure 4.4 The yield of paddy and maize before 1998 and in 2004

The mean value from the sales of vegetable for 148 respondents was also increased from 601 thousands *dong* before 1998 to 784 thousands *dong* in 2004. The average value of livestock was also improved from 1798.55 thousands *dong* before 1998 to 2693.46 thousands *dong* per year. Most of the respondents took advantages of agricultural production excess to raise livestock, such as cattle and poultry to generate extra income for the household.

4.6.2 Standard of living

The living standard of people has also improved considerably. The average income has increased to more 336 thousands *dong* per month for each household compare with their earnings before 1998. Most of them believed that the increase income was mainly due the higher agricultural productivity.

Table 4.11 Result of Pearson Correlation between average income and the total agricultural production (n=148)

		Average income per month	Total agricultural production in 2004
Average income per month	Pearson Correlation	1	.652**
	Sig. (2-tailed)	.	.001
	N	148	148
Total agricultural production in 2004	Pearson Correlation	.652**	1
	Sig. (2-tailed)	.001	.
	N	148	148

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

A correlation analysis has indicated that there is a positive, strong and very significant correlation ($r = 0.652$, $p = 0.001$) between the average income and the total agricultural production (Table 4.11).

This result can be attributed to the higher total agricultural production, which leads to higher average household income. Concreted irrigation schemes also play an important role in the increasing the total agricultural production. Almost all, that is 147 (99.3%) of the respondents have enough food for annual consumption, which is, about 209.95 kg of paddy for every month compare with 146.11 kg before 1998. During that time (before 1998), 71 (48%) of the households were not having enough rice to consume every month. Some families had to borrow money or rice from others and repay the lender of the next season. Therefore, the null hypothesis which stated that

there is significant relationship between the mean of income and the total agricultural production is accepted.

The survey found that, the average income before 1998 was about 660.9 thousands *dongs* per month and 997.2 thousands *dong* in 2004 (Figure 4.5). Therefore, the monthly income has increased by 50% compared with period 1998. As t - test was conducted to see the difference in the level of income during the time before 1998 and now. The result indicated that there is a significant difference in the level of income between two periods of time ($t = -37.164$ and value of $p = 0.00$). Consequently, the null hypothesis which stated that there is a significant difference in the level of income during the time before 1998 and 2004 is accepted.

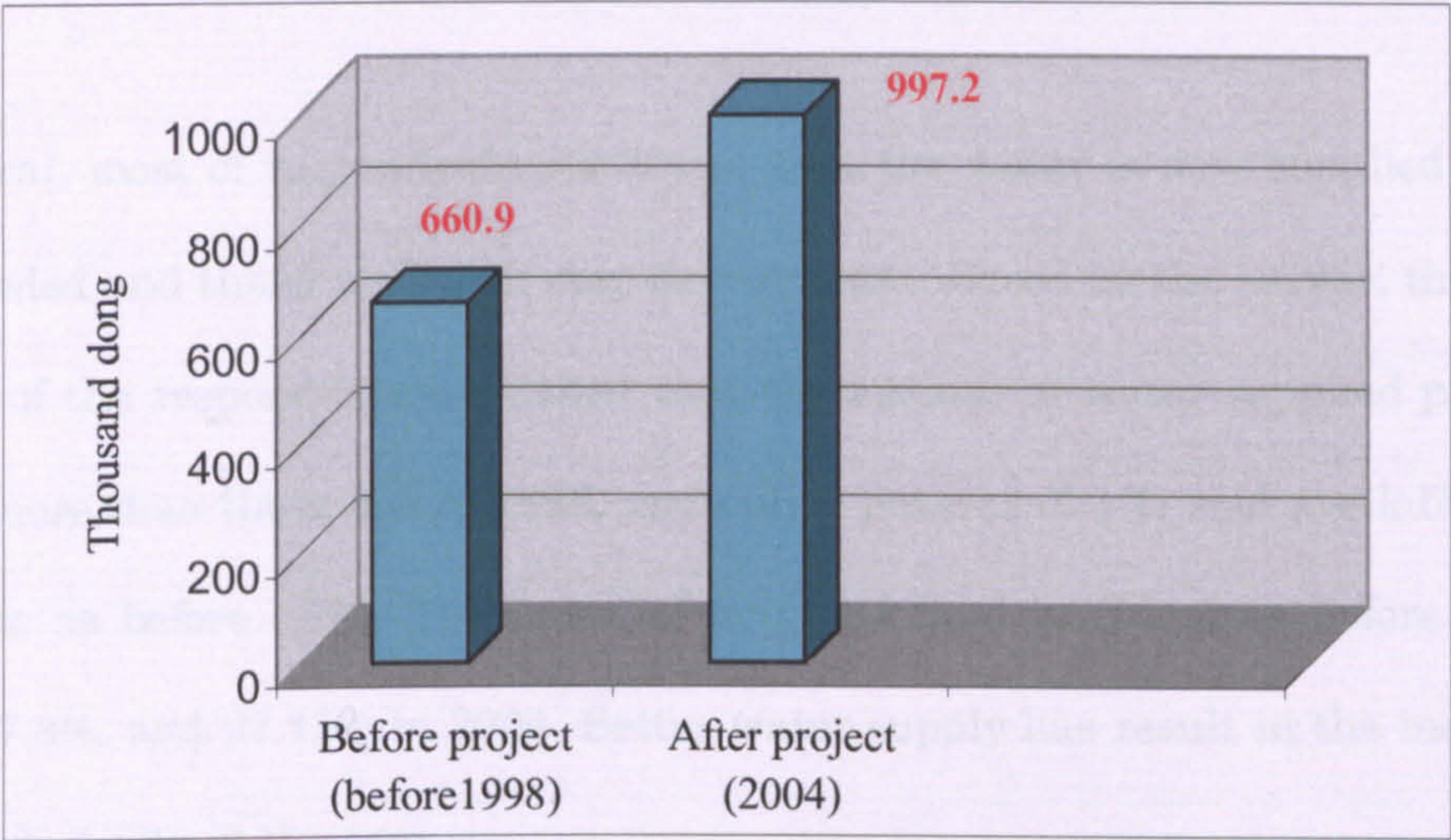


Figure 4.5 Monthly income before and after project

The increment in the household income can be attributed to the assistances from farmer association and B8A WUA. Through these assistances, the farmers are introduced new techniques, high quality seeds and guidance in the management and usage of water. For example, in 2004, 146 respondents (95.9%) received two technical

trainings compared with 4.7% during the time before 1998 where most of the respondents were only given once training per year by the farmer association.

4.6.3 Water supply

The main purpose of WUA is to ensure sufficient and timely supply of water. Water is supplied to B8A canal from the main North canal following the schedule of Chu River Irrigation Management Company. The water supply is normally closed and opened alternately throughout the year. The supply is opened for seven continuous days then it is closed for six days before it reopen for another seven days, and the cycle continues (Chu River IMC, 2004). After that, B8A WUA distributes the water to the downstream areas of the canal in the first two days, three days for middle part of canal and last two days for the upstream areas. While the water is being released to certain areas, water supply to the others areas are closed through a sluice control system.

In general, most of respondents confirmed that the water is now supplied totally as they needed and timed well with crop development. Based on the survey, the majority (93.9%) of the respondents concluded that the amount of water supplied per hectare now is more than those before 1998, and only 9 persons (6.1%) said available water is the same as before 1998. The mean of irrigated land in this area before 1998 was about 77.8%, and 97.41% in 2004. Better water supply has result in the increment of crop productivity in the area.

When asked of the main reason for changing to irrigated land, 101 persons (68.2%) answered that it was the result of WUA establishment and new irrigation system. Out of 148 respondents, 44 of them thought that the establishment of WUA and the introduction of new technologies contributed has caused the increment in water

supply. Only a small number of respondents considered that good weather and new technology in agriculture have caused the farmers to change to irrigated agriculture (Table 4.12).

Table 4.12 Frequency and percentage of respondents by main reasons for changing irrigated agriculture

Main reason	Frequency	Percentage
Establishment of WUA and new irrigation systems	101	68.2
Good weather	2	1.4
New technology applied on agriculture	1	0.7
WUA establishment and new technology	44	29.7
Total	148	100

An appropriate water supply and management system is not only to ensure enough water for the crops, but has also reduced the number of conflicts between users. The finding of the study indicated that majority of the respondents (98.6%) revealed that conflicts between users are less than those before 1998. The study also indicated that about 76.4% of respondents believed equally distributed water is the main for the decrement in conflict among users. The others, 19 (12.8%) persons thought that it is because of fewer number of people working in the agricultural sector. The rest (10.8%), however, believed that the reduction of conflicts among the users is due to the ability of the authorities to solve the problem more efficiently (Table 4.13).

Table 4.13 Main reason for changing the number of conflicts between users

Main reason	Frequency	Percentage
Water is distributed equally for everybody	113	76.4
There are not much people working in agricultural sector	19	12.8
Authority of communes treat conflicts strictly	16	10.8
Total	148	100

Another interesting finding of the study is, out of 62 respondents interviewed in the downstream, 60 of them (96.77%) answered that there is no differences in the amount of water supplied to both upstream and downstream areas. Only two persons said that it is still difficult for the downstream to get the same amount of water as the upstream.

In general, B8A WUA and concreted irrigation system have played an important role in the distribution of water equally to all users. Hence, they have increased water usage efficiency and also reduced the number of conflict. As the result, the agricultural productivity is improved and the social relationship is also strengthen. Thus, the overall situation is better than before the establishment of B8A WUA.

4.6.4 Health care

Generally, waterborne diseases are not a serious problem in this study area. The three main waterborne diseases here are diarrhea, skin diseases and malaria. Diarrhea is considered as the most common disease with the highest number of patients. There was average seven reported cases of this disease since 1990 to 1997. However, only a few cases of skin diseases and malaria were reported during the same period. Since 1998 to the present, there was only average four cases of these diseases were reported per year (Thieu Hoa Clinic, 2005). It is interesting to note that all respondents in the study answered that they did not go to clinic because of waterborne diseases. Most of the respondents, 141 (95.2%) believed that the water is unpolluted.

The water from the canal is mainly used for crop cultivation. However, it be concluded that the provision of water irrigation supply does indirectly reduced the case of waterborne disease in the area by improving the irrigation system in general.

4.6.5. Summary of research hypotheses results

In summary, three of the research hypotheses are accepted and one is rejected, as shown in Table 4.14.

Table 4.14 Research hypothesis results

Research hypotheses	Analysis	Hypothesis
H1: There is a significant relationship between the total paddy production and the percentage of land is irrigated in 2004	Pearson Correlation (r= 0.197, p < 0.05)	Accept
H2: There is a significant relationship between the average of income and the total agricultural production.	Pearson Correlation (r= 0.652, p < 0.01)	Accept
H3: There is a significant difference in the level of income during the time before 1998 and 2004.	T-test (t= -37.164, p <0.01)	Accept
H4: There is a significant relationship between age and the participation of water users in various activities and function of the WUA.	Pearson Correlation (p> 0.05)	Reject

CHAPTER 5

CONCLUSION

5.1 Introduction

The findings of the study are summarized in this chapter. The recommendation for the future studies are also included in this chapter.

5.2 Summary of the findings

The summary of the research findings are as follows:

1. Most of the respondents in the study area are farmers which household income depend heavily on the agricultural production. The majority of respondents are young people with an average age of 44-year-old and have completed secondary school (67.6%).
2. It was found that the B8A secondary canal is multi – commune models comprising three communes. B8A WUA Board of management consists of six people, i.e. the head of WUA, his deputy, an administrator, a supervisor, an accountant and a cashier who are elected from the three communes. Besides them, there are also irrigators who help the association in the delivery of water to the users. At the moment, there are 1079 users who are involved in the B8A WUA.
3. Thirdly, from survey, most of users really participate in this organization. They are involved mainly as members on water uses. At the annual meeting, users can express their opinions aimed at building up plans to manage water and distribute it efficiently. Majority of the respondents are

aware that the role of WUA establishment is important in both socio and economic aspects. All of them are satisfy with B8A WUA.

4. In term of cost – benefit analysis, the project could be accepted and considered efficient at 10% discount rate with 30 years life – span because the NPV is positive (1671.87 millions *dong*) and BCR is greater than 1. Moreover, project scenarios are used to compare efficiency with the original project. It is found that the project is efficient at 8%, 9%, 10% and at 11% for the second and third project scenario.
5. Finally, B8A WUA's establishment impacts directly and indirectly on beneficiaries. Most of respondents said that their agricultural production is increased since WUA was established. Their standard of living is also improved significantly. It can be seen that the average household income is increased before 1998 was 660.9 thousands *dong* and in 2004 it was 997.2 thousands *dong* per month. It means the monthly household income now is higher 50% than last time. The higher agriculture production is due to better management and water supply to the crops. Equal distribution of water also lead to reduce conflicts between users. So far, most of respondents in the down stream users confirmed that they could get water for cultivation in the same manners as upstream.

5.3 Recommendation

With all findings and discussions mentioned above, two recommendations are set forth for the authorities as well as relevant offices in order to improve B8A WUA model in particular, and other WUA in general.

First of all, Chu River IMC should give a higher ratio of remained water fee for B8A WUA. It can be seen that the estimated percentage between total O & M costs and the total collected water fees of the project is 14.93% (Appendix J). As mentioned earlier, WUA can keep only 12% of the total water fees, which appear to be insufficient to cover all actions like maintain and operation costs. Therefore, it is suggested that percentage should be 16% - 18% for WUA to ensure effective operation of the WUA.

In addition, B8A WUA's budget depends much on crop yield. If in the year of unfavorable conditions, water fees collected will be less, WUA's budget also will be reduced. Hence, WUA will not have enough resources to complete their tasks. Thieu Hoa People's Committee and Chu River IMC should, therefore, allow for compensation budget to WUA to ensure their smooth operation.

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Appendix A

Summary of Benefit Items of Irrigation Project

1. Private Benefit

Private benefit in million *dong* was counted for total for total area that B8A WUA managing (401ha) with total users are 1079 Furthermore, all benefit value for the whole project with 30 years life span at 10 % discount rate was counted with datum – level is year 2004.

1.1 Water fee

a. Water fee is counted based on some indicators as below:

B8A WUA manage total area is about 401ha, however the structure of water supply as the following:

Table 1a. Cultivation area distribution

Year	Area (ha)	Area 1 (ha)	Area 2 (ha)	Area 3 (ha)
1998	401	200	90	110
1999	401	200	100	100
2000	401	200	140	71
2001	401	300	70	31
2002	401	300	70	31
2003	401	300	70	31
2004	401	300	70	31
2005- 2025	401	300	70	31

Note:

Area 1: The water is naturally irrigable system without additional man – power or pumping.

Area 2: The water is partially irrigable naturally where water transportation requires additional assistance.

Area 3: Plantation does not require water supply as much as area 1 and 2.

From 1998 to 2001 based on Decision 1054 of People's Committee of Thanh Hoa Province applied water fee which counted in kilogram if paddy with difference area as the below:

Table 1b. Water fee level applied from 1998 to 2001

Area 1 (kg/ha/year)	Area 2 (kg/ha/year)	Area 3 (kg/ha/year)
486	385	202

From 2002 to 2004 Decision 1054 of People's Committee of Thanh Hoa province announced for applying water fee with difference area as the below and assumed that it will be continued until 2025:

Table 1c. Water fee level applied from 2002 to 2004

Area 1 (kg/ha/year)	Area 2 (kg/ha/year)	Area 3 (kg/ha/year)
471	404	189

Benefits are counted in total of the area (401ha) and based on the water fee level of People's Committee.

b. Price of paddy:

The price of paddy was 1.6 millions *dong* per ton from 1998 to 2000 and assumed it will keep at 1.8 millions *dong* per ton from 2001 to 2025.

The total water fee from 1998 to 2004 was collected from B8A WUA as the below:

Table 1d. Water fee from 1998 and estimated to 2025

Year	Quantity	Unit (Million dong/ton)
1998	150 tons	1.6
1999	160 tons	1.6
2000	130 tons (because of natural disaster)	1.6
2001	171 tons	1.8
2002	171 tons	1.8
2003	184 tons	1.8
2004	184 tons	1.8
2005-2025	184 tons	1.8

1.2 Water fee for small-scale canal

B8A WUA also has responsibility in manage small – scale canal. Water fee level is implemented according to Decision of People’s Council of three communes. B8A WUA collect water fee 120kg/ha/year.

1.3 Percentage from water fee given by the Government:

Thieu Hoa Irrigation Management Enterprise deducts 2% of the water fee for WUA.

Table 1e. Components of private benefits of irrigation project

Description	Year	Quantity	Unit	Total (Million dong/year)
1. Income from water fee	1998	150 tons	1.6 Md/ton	240
	1999	160 tons	1.6	256
	2000	130 tons (because of natural disaster)	1.6	208
	2001	171 tons	1.8	307.8
	2002	171 tons	1.8	307.8
	2003	184 tons	1.8	331.2
	2004	184 tons	1.8	331.2
	2005-2025	184 tons	1.8	331.2
2. Water fee for small-scale canal	1998-2000	401ha*0.12 ton/ha	1.6 Md/ha	76.99
	2001-2025	401ha*0.12 ton/ha	1.8 Md/ha	86.82
3. Percentage of water fee given by the Government	1998	2% * 246		4.8
	1999	2% * 256		5.12
	2000	2% * 208		4.16
	2001	2% * 307.8		6.16
	2002	2% * 307.8		6.16
	2003	2% * 331.2		6.62
	2004	2% * 331.2		6.62
	2005-2025	2% * 331.2		6.62

2. Public Benefits

2.1 Direct public benefits

2.1.1 Increased agriculture production:

Based on mean of agricultural production change was 3.28 millions dongs per year per household in 2004 compare before 1998. Assumption that there is about 60% of 1079 users now (from 2001 to 2025) and 756 users (from 1998 to 2000) whose production is higher than before 1998 is about 3.28 millions dong per year. Hence, total agriculture production increase is 2123.4 millions *dongs* per year from 2001 to 2025 [$3.28 \times 1079 \times 60\% = 2123.4$] and was 1487.8 millions *dong* per year from 1998 to 2000 [$3.28 \times 756 \times 60\% = 1487.8$]. However, assume that from 1998 to 2000, there was only 30% of the total production increased 446.34 millions dongs [$30\% \times 1487.8 = 446.34$] and from 2001 to 2005 and from 2020 to 2025, 60% of the increase total production increased 1274.04 millions dongs [$60\% \times 2123.4 \text{ millions} = 1274.04$] because nearly the end of the project, irrigated water may be reduced because of degraded canals. From 2006-2019, 80% of the total production may be increased 1698.72 millions dongs per year [$80\% \times 2123.4 \text{ millions} = 1698.72$].

2.1.2 Flood damage reduction

From interviewed head of B8A WUA, it was found that the concreted irrigation system and controlled water supply through WUA's irrigation schedule now help to reduce flood damage area about 90ha. However, flood damage reduction value will not be calculated separately because it is one of the factors causing increase in agriculture production that was counted above.

2.1.3 Reduce management cost

Before 1998, one staff of Thieu Hoa Irrigation Management Enterprise (IME) controlled two communes. After the establishment of WUA, one staff of Thieu Hoa IME controls three communes as a technical consultant. Their average salary is about 0.75 million per month. The salary for technical consultants now controlling 3 communes (once person) is 0.75 million *dong* per month. Before 1998, in order to control 3 communes needed 1.5 labor and the salary for the technical consultants was 1.125 million *dong* per month [$1.5 \times 0.75 = 1.125$]. Therefore, now the salary be saved 4.5 millions *dong* per year [$(1.125 - 0.75) \times 12 \text{ months} = 4.5$]

2.1.4 Terminal value

Assuming that after finish project, farmers will have infrastructure of B8A irrigation system as terminal value with 50% of the total value of the canals is 1041.15 millions *dong* [$2082.3 \times 50\% = 1041.15$ millions *dong*]. This is the public benefit especially for the three communes.

2.1.5 Increase water fee collection compare with before 1998

From the interview with the Thieu Hoa IME it was found that the water fee now is 100% collected in three communes compared with 80% during the time before the project. Therefore, the collected water fee increased 20%, however, this value would not be counted in public benefit because it is counted in water fee from 1998 to 2025. If it is still counted, double counting in water fee will happen in this case.

Table 2a. Components of Direct Public Benefits of Irrigation Project

Description	Year	Quantity	Total (Million dong /year)
1. Increased agriculture production	1998-2000	30%*1487.8	446.34
	2001-2005 & 2020-2025	60%* 2123.4	1274.04
	2006 – 2019	80%*2123.4	1698.72
2.Reduce management cost	1998-2025		4.5
3. Terminal value	2025	50% value of the B8A irrigation system	1041.15

2.2 Intangible benefits

2.2.1 Reduce food scarcity

From the survey, out of 148 respondent 48% of them said that their family was not enough food with mean of total paddy used about 146 kg (0.146 ton) per households per month before 1998. Now, 99.3% of respondents answered that they have enough food to consume every month, estimated about 210 kg (0.21 ton) per month. Consequently, food scarcity is reduced. This survey is assumed to apply for 48% of users did not have enough food before 1998 during 5 months per year. Food scarcity assumes still happening for 30% of 756 users from 1998 to 2000 and 20% of 1079 users from 2001 to 2003 and 10% of 1079 users from 2004 until the end of the project during 3 months per year. The price of paddy is 1.8 millions per ton from 2001 to 2030 and was 1.6 millions *dong* per ton from 1998 to 2000.

From 1998 to 2000, value of food scarcity reduction assumed 27.87millions dongs per year $[0.210\text{ton} - 0.146\text{ton}) * (48\%-30\%)* 756 *1.6 \text{ million/ton} * (5-3) \text{ months}= 27.87]$ and 69.61 millions *dong* from 2001 to 2003 $[(0.21 -0.146)* (48\% - 20%)* 1079* 1.8* (5-3) \text{ month}= 69.61]$, 94.47millions dongs per year from 2004 to 2025 $[(0.21 -0.146)* (48\% - 10%)* 1079* 1.8* (5-3) \text{ month }=94.47]$.

2.2.2 Reduce incidence of waterborne disease

Data from clinic found that the average 10 persons had to go to clinic before 1998 (from 1990 to 1997) for waterborne diseases. There was only average four persons still need to go clinic because of these diseases from 1998 to 2004. Results from survey shows that before 1998, one time went to the clinic, they had to spend 0.084 million dong per time and now costs 0.098 million dong per time. Hence, this project helps to reduce the number of people go to clinic, therefore, water in this area is not considered polluted. They go to clinic once time per year for both periods of time. Therefore, the incidence of waterborne disease reduction is 0.45 million dongs per year $[(10 \text{ persons} * 0.084) - (4 \text{ persons} * 0.098) = 0.45]$. Assume this situation is applied until the end of the project.

2.2.3 Increased irrigation efficiency

Increased irrigation efficiency is counted through time saved by the farmers. Before the project, about 77.8% of area was irrigated and now is 97.41%. The farmers needed more time to pump water to their field last time. It is assumed that the farmer had to go to pump once time per week and it took two hours per time and they went to the field 60% of the total time per year. Now, as the better irrigation system, water goes to the field easily, they need only 30 minutes to pump or getting water per time. They go to the field 40% of the total time per year. Assuming that, their income is 0.02 million *dong* per day – 8 hours (0.0025 million *dong* per hour) and 70% of the users get water in this case, the value of increased irrigation efficiency is 27.19 millions *dong* per year from 2001 to 2025 $[0.0025 * (2 \text{ hours} - 0.5 \text{ hour}) * 1 \text{ time} * 4 \text{ weeks} * 12 \text{ months} * (60\% - 40\%) * 1079 * 70\% = 27.19]$, and 19.05 millions *dong* per year from 1998 to 2000 $[0.0025 * (2 \text{ hours} - 0.5 \text{ hour}) * 1 \text{ time} * 4 \text{ weeks} * 12 \text{ months} * (60\% - 40\%) * 756 * 70\% = 19.05]$.

2.2.4 Skill improvement in irrigation system management

The knowledge of farmers has improved day by day. Before 1998, they were trained normally once per year. Now, WUA combine with farmer association implement training 2 times per year for farmers to introduce new technology, new technique, using and protecting water efficiency. Therefore, training helps production increase in indirect way. Assume that 50% (from 1998 to 2000) and 70% (from 2001 to 2025) of the users are improved their knowledge about agriculture and using water, with estimated value of knowledge increasing is 3% of the increase production (3.282 millions *dong*). Hence value of agricultural skill improvement from 1998 to 2000 was 37.22 millions *dong* [50% *756 households *3%*3.282= 37.22] and is 74.09 million *dong* from 2001 to 2025 [70% *1079 households *3%*3.282=74.09].

Table 2b. Components of Intangible Benefits of Irrigation Project

Description	Year	Total (Million dong/year)
1. Reduce food scarcity	1998- 2000	27.87
	2001-2003	69.61
	2001 -2025	94.47
2.Reduce incidence of waterborne disease	1998-2025	0.45
3.Increased irrigation efficiency	1998-2000	19.05
	2001-2025	27.19
4.Skill improvement in irrigation system management	1998-2000	37.22
	2001-2025	74.09

Note: The present value formula is $PV = \frac{FV}{(1+r)^n}$ applied from 2005 -2025 covert to 2004.

The future value formula is $FV = PV(1+r)^n$ applied from 1996 – 2003 convert to 2004.
where:

- PV: Present value
- FV: Future value
- r: Discount rate
- n: the period time of investment

Appendix B

Summary of Cost items of Irrigation Project

1. Private Cost

1.1 B8A construction costs

The life span of this irrigation project is 30 years. B8A canal is 4km length and two tertiary canals, which are B4 – 8A (1.25 km) and B2 – 8A (0.7km). Both tertiary canals also be concreted as same as B8A canal. B8A irrigation system also consists four sluices to control water. All costs to build this irrigation system are supported by Chu River Irrigation Management Company, Asian Development Bank Technique Assistance (ADB TA) office and People's Committees of Thieu Hoa District. As data from Chu river IMC, the average cost for 1km of concreted canal is about 343.8 millions dongs. And every two years, 1 km of canal is being concreted until the end of fourth kilometer of the B8A secondary canal. B2- 8A tertiary canal was built in 1997 cost 453 millions *dong* and B4- 8A tertiary canal was built in 2000 cost 253.8 millions *dong*.

1.2 Maintenance cost

Maintenance cost is counted as 40% of remained water fee that WUA keep. Assumed after every 6 years, the cost of the maintenance cost increase more 5% (from 2004 to 2008), 10% (from 2009 to 2013), 15% (from 2014 to 2018) and 20% from 2019 until the end of the project 2025 because the irrigation at that time will more and more be degraded.

1.3 Operation cost

Operation cost is counted as 50% of remained water fee that WUA keep. Operation cost includes salary of WUA Board members, administrative costs. The distribution of operation costs are distributed as below:

According to WUA's Ordinance, each members in the Board get 0.02 millions per month. For example, total salary for WUA Board members 14.4 millions *dong* [$6 \times 0.2 \times 12 \text{ months} = 14.4$]. Another operation costs supporting for meetings, administration costs.

1.4 Costs for water fee collection

Costs for water fee collection is counted as 30% of remained water fee that WUA keep.

1.5 Water fee returned to Chu River IMC

Water fee returned to Chu River IMC is 88% of B8a canal and sub canal water fee.

1.6 Office equipments for WUA

Office equipments for WUA costs 6 millions and assume every 10 years need to change new office equipments in 2006 and 2016.

1.7 Repair office cost

Every 10 years, B8A WUA need to carry out repair in the office building with the total cost is 8 million *dong* in 2006 and 2016.

1.8 Water fee reduction due to natural disaster

Water fee is reduced based on the level of damage. According to Resolution 112 *HDBT* and Decision 1054 of Thanh Hoa People's Committee announced that if agricultural

productivity is damaged 30 -50%, water fee will be reduced 30% of the standard water fee level and if agricultural productivity is damaged 50 -70%, water fee will be reduced 50%.

The data from WUA in 2000 indicates the total water fee was reduced 20% because of reduced production of 40 tons which accounted 23% of the total agricultural production (173 tons). It is assumed that WUA lost 20% water fee because of disaster every 6 years.

Table 3a. Components of private costs of irrigation project

Description	Year	Quantity	Unit	Total (million dong /year)
1.Canals Construction cost:				
1.1 B8A secondary canal	1996	1 km	343.8 Md/km	343.8
	1999	1 km	343.8 Md/km	343.8
	2002	1 km	343.8 Md/km	343.8
	2005	1km	343.8 Md/km	343.8
1.2 B2-8A tertiary canal	1997			253.8
1.3 B4- 8A tertiary canal	2000			453
2. Maintenance cost	1998	40% of remained water fee		15.22
	1999			15.98
	2000			13.68
	2001-2002			18.93
	2003			20.06
	2004-2008	More 5% the total of maintenance cost		21.06
	2009-2013	More 10% the total of maintenance cost		22.06
	2014-2018	More 15% the total of maintenance cost		23.06
	2019-2025	More 20% the total of maintenance cost		24.07
3. Operation cost	1998	50% of remained water fee		19.02
	1999			19.98
	2000			17.10
	2001-2002			23.66
	2003-2025			25.07

Table 3a (continue)

4. Cost for water fee collection	1998	30% of remained water fee		11.41
	1999			11.99
	2000			10.26
	2001-2002			14.20
	2003-2025			15.04
5. Water fee returned to Chu River IMC	1998	88% of total water fee		278.95
	1999			293.03
	2000			250.79
	2001-2002			347.09
	2003-2025			367.68
6. Office equipments for WUA	1998			6
	2006			6
	2016			6
7. Repair office cost every 10 years	2006			8
	2016			8
8. Fee reduction due to natural disaster	2000	20% of water fee in every 6 years		41.6
	2006			66.24
	2012			66.24
	2018			66.24
	2024			66.24

2. Public Costs

2.1 Office building cost

2.1.1 Construction of office building

The office was built in 1997 with the total costs was 20 millions *dong* and every 10 years need to repair and cost 8 million *dong* per time in 2006 and 2016.

(Note: B8A WUA borrowed one office which was built in 1996 from People’s Committee in Thieu Chinh Commune).

2.1.2 Land cost

Land cost for B8A WUA office is about 20m² and 0.8 million per m², therefore, land cost was 16 million *dong* in 1996 [20*0.8 = 16].

2.2 North Canal Construction costs

North Canal Construction costs are considered as public cost because North Canal provides water from Chu River to the B8A Canal. The concreted North Canals is 44.5 km length. North Canal supply water for 16 communes of the Thieu Hoa District and had been concreted for four years since from 1997 to 2000. Total construction costs of North Canal were 38094.2 millions *dong*. However, this project only count the North Canal construction costs as the public cost for three among 16 communes during 4 years. Therefore, the average of construction costs for three communes was 1785.67 millions *dong* per year [$38094.2 * 3/16/4\text{years} = 1785.67$] from 1997 to 2000.

2.3 Quy Xa sluice rehabilitation cost

In 1996, Quy Xa sluice rehabilitated and cost 500 millions *dong*. However, Quy Xa sluice control water for 31 communes. Therefore, B8A canal contributed thirtyfirst of Quy Xa sluice rehabilitation that cost 48.39 millions *dong* in 1996 [$500*3/31=48.39$].

2.4 Users contribution (in-kind maintenance costs)

From the survey, the average of labor value that users contribute is about 0.022 million per household per year and 0.031 million in term of cash. Therefore, assume about 70% of users contribute average 0.027 million dongs per year per household [$(0.031+0.022)/2=0.027$] and, 27 irrigators contributed 2.7 millions *dong* for WUA operation in 1998. The total value of users contribute in 1998 was 16.98 millions *dong* [$(0.027*70\%*756)+2.7=16.98$] and 14.29 millions *dong* per year from 1999 to 2000 [$0.027*70\%*756= 14.29$] and 20.39 millions *dong* [$0.027*70\%*1079= 20.39$] per year from 2001 to the end of the project.

2.5 Salary

Salary for engineering from IME

Salary for engineering from IME is 9 millions per year [1 person * 0.75 million/month*12 months= 9].

Salary for IME staffs

In order to ensure water from Chu river properly transmitted to canals, 20 persons from Chu Irrigation Management Enterprise's have to control Quy Xa Sluice water supply to the North canal and then B8A canal. Average their salary is about 0.75 million *dong* per person. It is assumed that 20 of them control the sluice and North canal only account 10% of their time. The total public cost for IME's management is 18 millions *dong* per year from 1998 to 2025 [$0.75 \times 20 \times 12 \times 10\% = 18$].

Salary for 27 irrigators

A total of 27 irrigators are hired have the responsibilities in the distribution of water, dredge up sub – canal. Their salary level is 0.2 million *dong* per month per person. Their salary is paid by farmers..

2.6 Environmental cost

2.6.1 Fruit tree loss

B8A canal passes by 80 households of Dan Tien, Dan Quyen, Thai Duong hamlet. When the canal is concreted, their fruit trees nearby the canal need to be cut down. From survey and interview results, there were estimated about 5 fruit trees for each household were cut and cost 0.1 million per trees. It is estimated that 25% of the 80 households have their trees being cut when they built 1km of canal. The lost to

environmental value in 1996, 1999, 2002, 2005 was estimated to be 10 millions *dong* per 1km canal [$25\% * 80 * 5 * 0.1 = 10$].

2.6.2 Fish loss

From the survey, using Contingent Value Method, out of 148 respondents, 57 of them could catch fish from the fields and canal as well. Before 1998, the average that each of household could catch was 20.8 kg per year. But now, the canals is concreted, therefore, not much fish could get into the fields and it is difficult to catch in the concreted canal. In 2004, they caught an average of about 11.5 kg per year per household. We assume that 20% of the population in three communes, 3973 households (Thieu Hoa Statistical Office, 2005) catch fish from the North and B8A canal as well as in their fields and 1kg of fish costs 0.016 million *dong*. The total value of fish loss is 118.24 millions *dong* per year from 1996 to 2025 [$0.016 * (20.8 - 11.5) * 20\% * 3973 = 118.24$].

2.6.3 Loss of vegetation located nearby the canal system

CVM found out that, the vegetation along the canal estimated was only 0.3 million *dong* per km in 2004 compared with 1.01 million *dong* per km during the time before 1998. Therefore the value of vegetation lost 0.71 million *dong* per year per km of canal [$(1.01 - 0.3) * 1\text{km} = 0.71$]. The main reason is concreted canals do not allow farmers to plant vegetable or others which are useful for livestock or selling. Hence, assume 80% of the total vegetation lost in both North Canal and B8A irrigation systems is 28.66 millions *dong* per year [$0.71 * 80\% * (4 + 1.25 + 0.7 + 44.5\text{km}) = 28.66$].

Table 3b. Components of public costs of irrigation project

Description	Year	Quantity	Unit	Total (million dong/year)
1. Office building cost				
1.1 Construction of office building	1997			20
1.2 Land cost	1996			16
2.North Canal construction costs	1997-2000	44.5km		1785.67 Md/year
3. Quy Xa sluice rehabilitation cost	1996	3 /31 communes		48.39
4. Users contribution	1998			16.98
	1999-2000			14.29
	2001-2025			20.39
5.Salary for engineering personnel from IME	1998-2025	1 person	0.75Md/month	9
6. Salary for IME's staffs	1998-2025	20 persons	0.75Md/month (10%)	18
7. Salary for 27 irrigators	1998 - 2025	27 persons	0.2 Md/month	64.8
8. Environmental cost				
8.1 Fruit tree loss (B8A)	1996	80 households with 5 trees each	0.001Md/tree	10
	1999			10
	2002			10
	2005			10
8.2 Fish loss (North & B8A canal systems)	1996-2025		0.016Md/kg	118.24
8.3 Vegetation loss (North & B8A canal systems)	1996-2025	50.45 km	0.71 Md/km	28.66

Note:

The present value formula is $PV = \frac{FV}{(1+r)^n}$ applied from 2005 -2025 covert to 2004.

The future value formula is $FV = PV(1+r)^n$ applied from 1996 – 2003 convert to 2004.

Where:

PV: Present value FV: Future value
r: Discount rate , n: the period time of investment

Appendix C

Summary of Benefits, Cost items for Project Scenarios

In order to assess the efficiency of the project, there are four project scenarios are assumed to analyze costs benefits.

Project scenario 1: Sensitivity analysis is used for the original project at the different discount rate level 8%, 9%, 10%, 11% and 12% with 30 year life span.

Project scenario 2: Assume, the life span of the project is 40 years and in the end of the project, the terminal value is only 25% of the canal construction cost. Private and public benefits, costs are still keeping the same original project. The terminal value in 2035 will be 520.575 millions *dong* [$2082.3 \times 25\% = 520.575$].

Project scenario 3: Assume the life span of the project is 40 years and the terminal value is about 25% of the canal construction cost. The terminal value in 2035 will be 624.69 millions *dong* [$2082.3 \times 25\% = 520.575$]. The increase of agricultural production still keep the same assumptions as the original project until 2025. However, efficiency of irrigation will be declined through the years, therefore the increase of agriculture production will be assumed to increase only 40% of 2123.4 millions *dong* (2.1.1, Appendix A) per year from 2026 to 2030 and 25% per year from 2031 to 2035. That means the agricultural production will increase 849.36 millions *dong* per year from 2026 to 2030 [$40\% \times 2123.4 = 849.36$] and 530.85 millions *dong* per year from 2031 to 2035 [$25\% \times 2123.4 = 530.85$]. Moreover, the maintain cost also will increase 50% from 2025 to 2035 because of degraded irrigation system.

Project scenario 4: Assume the life span of the project is 25 years and the terminal value is 60% of the construction cost in 2020. The terminal value in 2020 will be 1249.38 millions *dong* [$2082.3 \times 60\% = 1249.38$].

Appendix D

Household Survey Questionnaires in Thieu Hoa district

A - GENERAL INFORMATION

1. Village: _____

2. Name of respondent: _____

3. Age: _____

4. Gender:

☐ 01 – Male

☐ 02 – Female

5. Highest education level:

☐ 01 – No formal education

☐ 02 – Primary school

☐ 03 – Secondary school

☐ 04 - High school

☐ 05 - College (Diploma)

☐ 06- University (Bachelor)

☐ 07- Master or Phd

6. Occupation:

☐ 01 – Farmer

☐ 02 – Laborer

☐ 03 – Government Servant

☐ 04- Pensioner

☐ 05- Housewife

☐ 06 - Others (*please specific*) _____

B–AGRICULTURE AND IRRIGATION MANAGEMENT OF SCHEME PERPECTIVE

7. Total land for cultivation: _____ (hectares)

8. Agriculture produce – total and per hectare (in tone) before 1998:

Agriculture production	Rice		Bean/vegetable		Corn		Other crops and livestock	
	<i>Total</i>	<i>Per ha</i>	<i>Total</i>	<i>Per ha</i>	<i>Total</i>	<i>Per ha</i>	<i>Total</i>	<i>Per ha</i>
1 st crop								
2 rd crop								
Total								

9. Agriculture produce – total and per hectare (in tone) now (2004):

Agriculture production	Rice		Bean/vegetable		Corn		Other crops and livestock	
	Total	Per ha	Total	Per ha	Total	Per ha	Total	Per ha
1 st crop								
2 rd crop								
Total								

10. How much is your total agriculture production before 1998 and now?

- Before 1998: _____ VND/year
- Now: _____ VND/year

11. Compare with last time (since 1998), total average productivity is:

- [] 01 – Less [] VND/year
- [] 02 – Same
- [] 03 – More [] VND/year

12. If yes, the reasons for the change in productivity or total production crop are:

- [] 01 – Establishment of WUAs and new irrigation systems
- [] 02 – Good weather
- [] 03 - New technology applied on agriculture
- [] 04 - Others _____(please specific)

13. Is water released, as they are needed?

- [] 01 - Yes
- [] 02 - No

14. Does water release on time of crop?

- [] 01 - Yes
- [] 02 - No

15. Compare to last time (6 years ago), water irrigated per hectares is

- [] 01 – Less
- [] 02 – Same
- [] 03 – More

16. How much of your land is irrigated?

- + Before 1998: _____ %
- + Now: _____ %

17. If changed, what is the main reason for changing in this problem?

- ☐ 01 – Establishment of WUAs and new irrigation systems
- ☐ 02 – Good weather
- ☐ 03 - New technology applied on agriculture
- ☐ 04 - Others _____ (*please specific*)

18. Now, are there any differences in getting water between upstream & downstream?

(This question is used for respondents in the downstream of canal only)

- ☐ 01- Yes
- ☐ 02- No

19. If yes, for downstream it is:

- ☐ 01- Much more difficult than upstream
- ☐ 02- More difficult than upstream
- ☐ 03- No significant different between downstream and upstream.

20. How often have you attend meeting of B8A WUAs?

- ☐ 01 - Never
- ☐ 02 – Sometimes
- ☐ 03 - Often
- ☐ 04 - Always

21. Do you involve net work design ?

- ☐ 01 – Yes
- ☐ 02 – No

22. Do you involve canal construction?

- ☐ 01 – Yes
- ☐ 02 – No

23. Do you involve water distribution?

- ☐ 01 – Yes
- ☐ 02 – No

24. Do you involve water use policy establishment?

- ☐ 01 – Yes
- ☐ 02 – No

25. Do you involve fee administration?

- ☐ 01 – Yes
- ☐ 02 – No

26. Do you involve canal maintenance ?

☐ 01 – Yes

☐ 02 – No

27a. How many time did your family receive technical training in agriculture before 1998? _____ times/ year.

27b. How many time do your family receive technical training in agriculture now (since 1998) ? _____ times/year.

28. Who has provided this training?

☐ 01 – Extension Staff

☐ 02 - Farmer Association

☐ 03 - Government

☐ 04 – B8AWUA

☐ 05 - Others _____ (*please specific*)

29. Do you participate in B8A WUAs ?

☐ 01 – Yes

☐ 02 – No

30. If no, please explain:

31. If yes, which is your position in B8A WUA?

☐ 01 – Member only, not actively using water

☐ 02- Member, actively using irrigation water

☐ 03- Member and also committee member

☐ 04- Member, employed by B8A WUA.

32. Do you really pay discharge fee?

☐ 01 – Yes

☐ 02 – No

33. How the water fees changed since B8AWUA are established?

☐ 01 – Big increase

☐ 02 - Slight increase

☐ 03 - Same

☐ 04 – Slight decrease

☐ 05 - Big decrease

34. How much did you pay for water fee before 1998 per year? _____ VND/year

35. How much do you pay for water fee now per year? _____ VND/year

36. Who collect the water fees?

- ☐ 01 – Members of Irrigation Management Company
- ☐ 02 - People’s Committee
- ☐ 03 - Contractors
- ☐ 04 – B8A WUA
- ☐ 05 - Others _____ (*please specific*)

37a. Do your family contribute labor to built/ rehabilitate irrigation system?

- ☐ 01 – Yes
- ☐ 02 – No

37b. If yes, how many man do you contribute per year?_____ VND/year

38a. Do your family contribute materials to built/ rehabilitate irrigation system?

- ☐ 01 – Yes
- ☐ 02 – No

38b. If yes, how much material do you contribute per year?_____ VND/year

39a. Do your family contribute cash to built/ rehabilitate irrigation system?

- ☐ 01 – Yes
- ☐ 02 – No

39b. If yes, how much cash do you contribute per year?_____ VND/year

C – SOCIAL – ECONOMIC PERSPECTIVE

40. Average income: _____ VND/month

41. Source of income (please indicate number in the table below):

Source of income	VND/ month
1. Salary	
2. Rice	
3. Vegetable +bean+ peanut	
4. Fruit	
5. Cattle and poultry	
6. Others _____ ((<i>please specific</i>))	
Total	

42. Compare last time (before 1998), your income increase per year:

- ☐ 01 – Less in percentage VND/month
- ☐ 02 – Same
- ☐ 03 – More in percentage VND/month

43. How much you spent for every month? _____ VND /month

44. Source of expenditure:

Source of expenditure	VND/ month
1. Food	
2. Children education	
3. Transportation	
4. Water fee	
5. Others _____	
Total	

45a. Compare last time (before 1998), your family spent money per year:

- ☐ 01 – Less VND/year
- ☐ 02 – Same
- ☐ 03 – More VND/ year

45b. If yes, does expenditure increase caused by water fee?

- ☐ 01- Yes
- ☐ 02- No

45c. If yes, how much do you have to spent more money for water fee compare with before 1998? _____ VND/year

46. Is there any new job that your family has since WUA has established?

- ☐ 01 - Yes
- ☐ 02 – No

47a. Compare last time (before 1998), the number of job in your family:

- ☐ 01 – Less
- ☐ 02 – Same
- ☐ 03 – More

47b. How many jobs in your family before 1998 and now?

- + Before 1998: _____ jobs
- + Now: _____ jobs

48. Did your family enough food before 1998?

- ☐ 01 - Yes
- ☐ 02 – No

49. Do your family enough food now (since 1998)?
- ☐ 01 - Yes
- ☐ 02 – No
50. If yes, how many kg of rice did you family consume per month before 1998? _(kg)
51. If yes, how many kg of rice do you family consume per month now? _____(kg)
52. Compare last time (before 1998), the number of conflict between users
- ☐ 01 – Less
- ☐ 02 – Same
- ☐ 03 – More
53. If changed, what is the main reason for the change in that problem?
- ☐ 01 – Water is distributed equally for everybody
- ☐ 02- There are not much people working in agricultural sector
- ☐ 03- Authority of commune treat any conflict strictly
- ☐ 04 – Others_____(*please specific*).

D- PERCEPTION OF FARMER IN PARTICIPATION IRRIGATION MANAGEMENT

1- Strong disagree 2 – Disagree 3- Uncertain 4- Agree 5- Strong agree

	1	2	3	4	5
54. The irrigation system is for farmer/community					
55. Farmer participated to design, investigate irrigation system					
56.The level of water fee is suitable					
57. Productivity of rice in your family increases from this irrigation system					
58. Your family's income is increased through this irrigation system					
59. Your family's jobs are diversified from this irrigation					
60. WUA helps community closer together					
61. WUA ensures equality between users					
62. The knowledge of protection of water resources as well as agriculture increased through PIM					
63. The combination between government and WUAs / community in PIM lead to higher irrigated efficiency					
64. The role of farmer's participation in managing irrigation system (IS) is very important.					
65. All participators have the same right inB8A WUA in managing IS					
66. The opportunities of job has been increasing for 3 communes though this project.					
67. You are satisfied with B8A WUA					

E – ENVIRONMENTAL PERSPECTIVES

68. Compare with last time (before 1998), do your family have to go to clinic more frequently every year?

☐ 01- Yes

☐ 02 – No

69. If yes, how often did your family's member go to clinic per year before 1998?

☐ 01- Very frequently (every month)

☐ 02- Frequently (every 2 months)

☐ 03- Sometimes (3 times per year)

☐ 04 – Rarely (1 or 2 times per year)

☐ 05 – Never

70. If yes, how often did your family's member go to clinic per year now?

☐ 01- Very frequently (every month)

☐ 02- Frequently (every 2 months)

☐ 03- Sometimes (3 times per year)

☐ 04 – Rarely (1 or 2 times per year)

☐ 05 – Never

71. How much did you need to pay for 1 time to go to clinic before 1998? __VND/time.

72. How much did you need to pay for 1 time to go to clinic now? _____VND/time.

73. Do you go to clinic because of related water disease like malaria, diarrhea?

☐ 01 – Yes

☐ 02- No

74. Do you think water is polluted in your area?

☐ 01 – Yes

☐ 02- No

76. How many percent of water polluted caused by irrigation project? _____%

77. How much are you willing to pay for water treatment/year? _____ VND/year

78. Did your family have to cut down fruit trees for canal building?

☐ 01 – Yes

☐ 02- No

79. If yes, how many fruit trees in your garden had to cut? _____ trees

80. How much do you willing to accept for one fruit tree value cut down in order to build the canal? _____ VND/tree

81. Did your family catch fish from North Canal and B8A canal systems before 1998?

☐ 01 – Yes

☐ 02- No

82. If yes, how many kg of fish did your family catch before 1998 per year? __kg/year

83. Do your family catch fish from North Canal and B8A canal systems now?

☐ 01 – Yes

☐ 02- No

84. If yes, how many kg of fish do your family catch per year now? _____kg/year

85. Did your family plant vegetable along North Canal and B8A canal systems before 1998?

☐ 01 – Yes

☐ 02- No

86. If yes, how much did your family earn from planting vegetable along the canal per year before 1998? _____ VND/year (including vegetable for livestock)

87. Do your family plant any vegetable along North Canal and B8A canal systems now?

☐ 01 – Yes

☐ 02- No

88. If yes, how much do your family earn from planting vegetable along the canal per year now? _____ VND/year (including vegetable for livestock)

Appendix E

Questionnaire for Managers of B8A WUA in Thieu Hoa District

1. Name of respondent: _____
2. Age: _____
3. Gender:

- ☐ 01 – Male
- ☐ 02 – Female

5. Position: _____
6. Irrigation capacity per crop in total area:

Designed		Actual	
In ha	In 1000m³	In ha	In 1000m³

7. Since WUA was established, the irrigated area is:
- ☐ 01- Increased
- ☐ 02- Same
- ☐ 03- Decreased

8. Does WUA have enough members to manage irrigation system (IS)?
- ☐ 01- Yes
- ☐ 02- No

- 8a. How many number of staff/people that is involved in management IS? (WUA)
- (indicate number in box)* persons

8b. How many of them are the following (*indicate number in box*):

- * IMC – staff

[] person
- * Head of scheme

[] person
- * Workers

[] person
- * Accountant

[] person
- * Boad of co- operative

[] person
- * Members of co – operative

[] person
- * Farmers

[] per son
- * Others

[] person

9. Can you describe the role of each staff/ person who is involved in the management?

Position	Task
1. IMC – staff	
2. Head of scheme	
3. Workers	
4. Accountant	
5. Board of co- operative	
6. Members of co – operative	
7. Farmers	
8. Others	

10. Are there any regulation for WUA in term of responsibilities, control IS?

- [] 01- Yes
- [] 02- No

11. Who made these regulations?

- [] 01- Government & B8A WUA
- [] 02- B8A WUA’s manager
- [] 03- Government and WUA & participators
- [] 04- Others_____

12. In what way are the farmers involved in the setting up the regulations?

13. What regulation refers to the contribution of labor and water fees?

14. Who are involved in the implementation of these regulations?

15. Who made the final decision concerning the level of the water fees?

16. What is the standard for calculating the water fees?

Standard for fee calculation	(Tick the right box)	Level of water fee	
		In VND	In rice (kg)
Volumetric			
Standard per hectare			
Standard/ household			
Standard/person/household			
Others			

17. Has money been collected completely every year?

☐ 01- Yes

☐ 02- No

18. How many users pay their water fee (%)? _____

19. How many hectares of irrigated land which water fees have been collected (%)? _

21. Who is managing the water fee fund? _____

22. What is collected water fees used as the below:

Usage of water fee in	%
1. Maintenance & repair	
2. Upgrading & new construction	
3. Remuneration for management	
4. Operational cost	
5. Water resources tax	
6. Commission for fee collection	
7. Other cost (risk/reward)	
8. Contingency	
9. Others costs	

23. Are expenditures announced in public (or made known to member of WUA)?

☐ 01- Yes

☐ 02- No

24. If yes, how often does WUA announce its financial planning to member of WUA?

☐ 01 - Never

☐ 02 – Sometimes

☐ 03 - Often

☐ 04 - Always

23. Who is making final decision concerning fund allocation? _____

24. How many percentage of irrigating household contributed labor? _____ (%)

25. How many times do farmers get irrigation water during a crop cycle? _____

26.How many times does B8A WUA have meeting with participants?

- ☐ 01 - Never
- ☐ 02 – Sometimes
- ☐ 03 - Often
- ☐ 04 - Always

27. Can you describe the principle of the meeting (how is going on)?

28. What is problem now that B8A WUA has to face?

Appendix F1

Cost Benefit Analysis for B8A Canal- Project scenario 1 at 8% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86	#####	2323.86
Present benefits	0.00	0.00	1469.12	1386.20	1211.58	2517.52	2331.04	2186.21	1899.18	1628.24	1844.76	1708.11	1581.58	1464.43	1355.95
Total present benefits			33808.59												
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8					
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6				
7 Repair B8A WUA office building											8				
8 Fee reduction due to natural disister					41.6						66.24				
II.2 Public costs															
9 Construction B8A WUA office building	20														
10 Land cost for B8A WUA office	16														
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67										
12 Quy Xa Sluice rehabilitation cost	48.39														
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10					
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93	688.93	688.93
Present costs	1169.58	4427.16	4054.80	4337.61	3858.28	901.96	1280.83	801.23	687.93	893.12	609.80	505.65	468.19	434.15	401.99
Total present costs			28350.55												
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93	1634.93	1634.93
NPV			5458.05												
IRR			13%												
B/C ratio			1.19												

Appendix F1

Description	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															1041.15
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18	1899.18	1899.18	1899.18	2940.33
Present benefits	1255.51	1162.51	1076.40	996.66	922.84	854.48	791.18	732.58	678.31	513.29	475.27	440.06	407.47	377.28	540.85
Total present benefits															
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost															
2 Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA						6									
7 Repair B8A WUA office building						8									
8 Fee reduction due to natural disaster		66.24						66.24						66.24	
II.2 Public costs															
9 Construction B8A WUA office building															
10 Land cost for B8A WUA office															
11 Main Cannal Construction (partial) cost															
12 Quy Xa Sluice rehabilitation cost															
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees															
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94	690.94	690.94	757.18	690.94
Present costs	372.21	377.78	319.11	295.90	273.98	258.84	234.90	238.38	201.68	186.74	172.91	160.10	148.24	150.42	127.09
Total present costs															
Net profit	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24	1208.24	1208.24	1142.00	2249.39

Appendix F2

Cost Benefit Analysis for B8A Canal- Project scenario 1 at 9% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86	#####	2323.86
Present benefits	0.00	0.00	1567.03	1465.01	1268.72	2612.06	2396.39	2226.88	1899.18	1598.50	1794.45	1646.28	1510.35	1385.64	1271.23
Total present benefits			32565.26												
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8					
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6				
7 Repair B8A WUA office building											8				
8 Fee reduction due to natural disaster					41.6						66.24				
II.2 Public costs															
9 Construction B8A WUA office building	20														
10 Land cost for B8A WUA office	16														
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67										
12 Quy Xa Sluice rehabilitation cost	48.39														
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10					
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93	688.93	688.93
Present costs	1270.73	4765.93	4325.03	4584.24	4040.24	935.83	1316.74	816.14	687.93	876.80	593.17	487.35	447.11	410.79	376.87
Total present costs			29041.25												
Net profit	-585.08	-2391.86	-1508.72	-1869.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93	1634.93	1634.93
NPV			3524.02												
IRR			13%												
B/C ratio			1.12												

Appendix F2

Description		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I	Benefits															
I.1	Private benefits															
1	Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2	Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3	Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2	Public benefits															
4	Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5	Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6	Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7	Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8	Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9	Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10	Terminal value															1041.15
	Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18	1899.18	1899.18	1899.18	2940.33
	Present benefits	1166.27	1069.97	981.62	900.57	826.21	757.99	695.41	637.99	585.31	438.85	402.61	369.37	338.87	310.89	441.58
	Total present benefits															
II	Costs															
II.1	Private costs															
1	B8A Cannals Construction cost															
2	Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3	Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4	Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5	Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6	Equipments for B8A WUA						6									
7	Repair B8A WUA office building						8									
8	Fee reduction due to natural disister		66.24						66.24						66.24	
II.2	Public costs															
9	Construction B8A WUA office building															
10	Land cost for B8A WUA office															
11	Main Cannal Construction (partial) cost															
12	Quy Xa Sluice rehabilitation cost															
13	Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14	Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15	Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16	Salary for 27 irirgators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17	Lost fruit trees															
18	Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19	Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
	Total costs	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94	690.94	690.94	757.18	690.94
	Present costs	345.75	347.70	291.01	267.37	245.30	229.61	206.46	207.60	174.03	159.66	146.47	134.38	123.29	123.95	103.77
	Total present costs															
	Net profit	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24	1208.24	1208.24	1142.00	2249.39

Appendix F3
Cost Benefit Analysis for B8A Canal- Project scenario 1 at 10% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86	#####	2323.86
Present benefits	0.00	0.00	1670.48	1647.63	1327.99	2709.25	2462.95	2267.93	1899.18	1569.57	1745.95	1587.23	1442.93	1311.76	1192.51
Total present benefits			31530.95												
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8					
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6				
7 Repair B8A WUA office building											8				
8 Fee reduction due to natural disaster					41.6					66.24					
II.2 Public costs															
9 Construction B8A WUA office building	20														
10 Land cost for B8A WUA office	16														
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67										
12 Quy Xa Sluice rehabilitation cost	48.39														
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs			18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10					
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93	688.93	688.93
Present costs	1379.59	6127.16	4610.54	4842.44	4229.01	970.65	1353.32	831.18	687.93	860.04	577.14	469.87	427.15	388.89	353.53
Total present costs			29859.08												
Net profit	-585.08	-2391.86	-1608.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93	1634.93	1634.93
NPV			1671.87												
IRR			13%												
B/C ratio			1.06												

Appendix F3

Description	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															1041.15
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18	1899.18	1899.18	1899.18	2040.33
Present benefits	1084.10	985.54	895.95	814.50	740.45	673.14	611.95	556.31	505.74	375.74	341.58	310.53	282.30	256.64	361.21
Total present benefits															
II Costs															
II.1 Private costs															
1 B8A Canals Construction cost															
2 Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA						6									
7 Repair B8A WUA office building						8									
8 Fee reduction due to natural disaster		66.24						66.24						66.24	
II.2 Public costs															
9 Construction B8A WUA office building															
10 Land cost for B8A WUA office															
11 Main Canals Construction (partial) cost															
12 Quy Xa Sluice rehabilitation cost															
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees															
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94	690.94	690.94	757.18	690.94
Present costs	321.39	320.27	265.61	241.82	219.84	203.91	181.68	181.02	150.37	136.70	124.27	112.97	102.70	102.32	84.88
Total present costs															
Net profit	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24	1208.24	1208.24	1142.00	2249.39

Appendix F4

Cost Benefit Analysis for B8A Canal- Project scenario 1 at 11% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86	#####	2323.86
Present benefits	0.00	0.00	1779.73	1633.88	1389.47	2809.12	2530.74	2309.35	1899.18	1541.42	1699.19	1530.80	1379.10	1242.43	1119.31
Total present benefits			30679.01												
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8					
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6				
7 Repair B8A WUA office building											8				
8 Fee reduction due to natural disaster					41.6						66.24				
II.2 Public costs															
9 Construction B8A WUA office building	20														
10 Land cost for B8A WUA office	16														
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67										
12 Quy Xa Sluice rehabilitation cost	48.39														
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs			18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10					
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93	688.93	688.93
Present costs	1496.65	5512.13	4912.07	5112.65	4424.76	1006.43	1390.56	846.36	687.93	845.49	561.68	453.16	408.25	368.33	331.83
Total present costs			30798.48												
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93	1634.93	1634.93
NPV			-119.47												
IRR			13%												
B/C ratio			0.99												

Appendix F4

Description	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															1041.15
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18	1899.18	1899.18	1899.18	2040.33
Present benefits	1008.38	908.45	818.43	737.32	664.25	598.43	539.12	485.70	437.56	322.16	290.24	261.47	235.56	212.22	296.00
Total present benefits															
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost															
2 Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA						6									
7 Repair B8A WUA office building						8									
8 Fee reduction due to natural disaster		66.24						66.24						66.24	
II.2 Public costs															
9 Construction B8A WUA office building															
10 Land cost for B8A WUA office															
11 Main Cannal Construction (partial) cost															
12 Quy Xa Sluice rehabilitation cost															
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees															
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94	690.94	690.94	757.18	690.94
Present costs	298.95	295.22	242.63	218.91	197.21	181.27	160.06	158.04	130.10	117.21	105.59	95.13	85.70	84.61	69.56
Total present costs															
Net profit	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24	1208.24	1208.24	1142.00	2249.39

Appendix F5

Cost Benefit Analysis for B8A Canal- Project scenario 1 at 12% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86	#####	2323.86
Present benefits	0.00	0.00	1895.04	1724.21	1453.19	2911.72	2599.75	2351.15	1899.18	1514.02	1654.08	1476.86	1318.62	1177.34	1051.20
Total present benefits			29967.14												
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8					
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6				
7 Repair B8A WUA office building											8				
8 Fee reduction due to natural disaster					41.6						66.24				
II.2 Public costs															
9 Construction B8A WUA office building	20														
10 Land cost for B8A WUA office	16														
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67										
12 Quy Xa Sluice rehabilitation cost	48.39														
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10					
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93	688.93	688.93
Present costs	1622.47	5922.15	5230.33	5395.31	4627.70	1043.19	1428.48	861.68	687.93	830.46	546.77	437.19	390.35	349.04	311.64
Total present costs			31855.40												
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93	1634.93	1634.93
NPV			-1868.26												
IRR			13%												
B/C ratio			0.94												

Appendix F5

Description	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Benefits															
I.1 Private benefits															
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits															
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value															1041.15
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18	1899.18	1899.18	1899.18	2940.33
Present benefits	938.57	838.01	748.22	668.05	596.48	532.57	475.51	424.56	379.07	276.60	246.97	220.51	196.88	175.79	243.00
Total present benefits															
II Costs															
II.1 Private costs															
1 B8A Cannals Construction cost															
2 Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA						6									
7 Repair B8A WUA office building						8									
8 Fee reduction due to natural disaster		66.24						66.24						66.24	
II.2 Public costs															
9 Construction B8A WUA office building															
10 Land cost for B8A WUA office															
11 Main Cannal Construction (partial) cost															
12 Quy Xa Sluice rehabilitation cost															
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees															
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94	690.94	690.94	757.18	690.94
Present costs	278.25	272.32	221.82	198.34	177.09	161.32	141.17	138.15	112.71	100.63	89.85	80.22	71.63	70.08	57.10
Total present costs															
Net profit	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24	1208.24	1208.24	1142.00	2249.39

Appendix G1

Cost benefit analysis in B8A WUA- Project Scenario 2 at 8% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1469.12	1386.20	1211.58	2517.52	2331.04	2186.21	1899.18	1628.24	1844.76	1708.11	1581.58
Total present benefits			36005.51										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	535.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1169.58	4427.16	4054.80	4337.61	3858.28	901.96	1280.83	801.23	687.93	893.12	609.80	505.65	468.19
Total present cost			29214.02										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			6791.49										
IRR			13%										
B/C ratio			1.23										

Appendix G1

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1464.43	1355.95	1255.51	1162.51	1076.40	996.66	922.84	854.48	791.18	732.58	678.31	513.29	475.27
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Canals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Canals Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	494.15	401.99	372.21	377.78	319.11	295.90	273.98	258.84	234.90	238.38	201.68	186.74	172.91
Total present cost													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix G1

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	2419.76
Present benefits	440.06	407.47	377.28	349.34	323.46	299.50	277.31	256.77	237.75	220.14	203.83	188.74	174.76	206.16
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Canal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	690.94	704.94	690.94	690.94	690.94	757.18	690.94	690.94	690.94	690.94	690.94
Present costs	160.10	148.24	150.42	127.09	120.06	108.96	100.89	93.42	94.79	80.09	74.16	68.66	63.58	58.87
Total present cost														
Net profit	1208.24	1208.24	1142.00	1208.24	1194.24	1208.24	1208.24	1208.24	1142.00	1208.24	1208.24	1208.24	1208.24	1728.82

Appendix G2

Cost benefit analysis in B8A WUA- Project Scenario 2 at 9% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1567.03	1465.01	1268.72	2612.06	2396.39	2226.88	1899.18	1598.50	1794.45	1646.28	1510.35
Total present benefits			34272.38										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1270.73	4765.93	4325.03	4584.24	4040.24	935.83	1316.74	816.14	687.93	876.80	593.17	487.35	447.11
Total present cost			29715.58										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			4556.80										
IRR			13%										
B/C ratio			1.15										

Appendix G2

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1385.64	1271.23	1166.27	1069.97	981.62	900.57	826.21	757.99	695.41	637.99	585.31	438.85	402.61
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	410.79	376.87	345.75	347.70	291.01	267.37	245.30	229.61	206.46	207.60	174.03	159.66	146.47
Total present cost													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix G2

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	2419.76
Present benefits	369.97	338.87	310.89	285.22	261.67	240.07	220.24	202.06	185.37	170.07	156.03	143.14	131.32	153.51
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	690.94	704.94	690.94	690.94	690.94	757.18	690.94	690.94	690.94	690.94	690.94
Present costs	134.38	123.29	123.95	103.77	97.13	87.34	80.13	73.51	73.91	61.87	56.76	52.08	47.78	43.83
Total present cost														
Net profit	1208.24	1208.24	1142.00	1208.24	1194.24	1208.24	1208.24	1208.24	1142.00	1208.24	1208.24	1208.24	1208.24	1728.82

Appendix G3

Cost benefit analysis in B8A WUA- Project Scenario 2 at 10% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1670.48	1547.63	1327.99	2709.25	2462.95	2267.93	1899.18	1569.57	1745.95	1587.23	1442.93
Total present benefits			32861.27										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Shuice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1379.59	5127.16	4610.54	4842.44	4229.01	970.65	1353.32	831.18	687.93	860.94	577.14	469.87	427.15
Total present cost			30387.24										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			2474.03										
IRR			13%										
B/C ratio			1.08										

Appendix G3

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1311.76	1192.51	1084.10	985.54	895.95	814.50	740.45	673.14	611.95	556.31	505.74	375.74	341.58
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Canals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Canals Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	388.89	353.53	321.39	320.27	265.61	241.82	219.84	203.91	181.68	181.02	150.37	136.70	124.27
Total present cost													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix G3

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	2419.76
Present benefits	310.53	282.30	256.64	233.31	212.10	192.82	175.29	159.35	144.87	131.70	119.72	108.84	98.94	114.61
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	690.94	704.94	690.94	690.94	690.94	757.18	690.94	690.94	690.94	690.94	690.94
Present costs	112.97	102.70	102.32	84.88	78.73	70.15	63.77	57.97	57.76	47.91	43.56	39.60	36.00	32.72
Total present cost														
Net profit	1208.24	1208.24	1142.00	1208.24	1194.24	1208.24	1208.24	1208.24	1142.00	1208.24	1208.24	1208.24	1208.24	1728.82

Appendix G4

Cost benefit analysis in B8A WUA- Project Scenario 2 at 11% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1779.73	1633.88	1389.47	2809.12	2530.74	2309.35	1899.18	1541.42	1699.19	1530.80	1379.10
Total present benefits			31718.60										
II Costs													
II.1 Private costs													
1 B8A Canals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Canals Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1496.65	5512.13	4912.07	5112.65	4424.76	1006.43	1390.56	846.36	687.93	845.49	561.68	453.16	408.25
Total present cost			31213.33										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			505.27										
IRR			13%										
B/C ratio			1.02										

Appendix G4

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1242.43	1119.31	1008.38	908.45	818.43	737.32	664.25	598.43	539.12	485.70	437.56	322.16	290.24
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Canals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Canal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	368.33	331.83	298.95	295.22	242.63	218.91	197.21	181.27	160.06	158.04	130.10	117.21	105.59
Total present cost													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix G4

Description		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I	Benefits														
I.1	Private benefits														
1	Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2	Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3	Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2	Public benefits														
4	Increased agriculture production	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5	Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6	Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7	Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8	Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9	Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10	Terminal value														520.575
	Total benefits	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	2419.76
	Present benefits	261.47	235.56	212.22	191.19	172.24	155.17	139.80	125.94	113.46	102.22	92.09	82.96	74.74	85.79
	Total present benefits														
II	Costs														
II.1	Private costs														
1	B8A Cannals Construction cost														
2	Maintenance cost	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3	Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4	Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5	Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6	Equipments for B8A WUA					6									
7	Repair B8A WUA office building					8									
8	Fee reduction due to natural disister			66.24						66.24					
II.2	Public costs														
9	Construction B8A WUA office building														
10	Land cost for B8A WUA office														
11	Main Cannal Construction (partial) cost														
12	Quy Xa Sluice rehabilitation cost														
13	Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14	Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15	Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16	Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17	Lost fruit trees														
18	Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19	Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
	Total costs	690.94	690.94	757.18	690.94	704.94	690.94	690.94	690.94	757.18	690.94	690.94	690.94	690.94	690.94
	Present costs	95.13	85.70	84.61	69.56	63.93	56.45	50.86	45.82	45.24	37.19	33.50	30.18	27.19	24.50
	Total present cost														
	Net profit	1208.24	1208.24	1142.00	1208.24	1194.24	1208.24	1208.24	1208.24	1142.00	1208.24	1208.24	1208.24	1208.24	1728.82

Appendix G5

Cost benefit analysis in B8A WUA- Project Scenario 2 at 12% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1895.04	1724.21	1453.19	2911.72	2599.75	2351.15	1899.18	1514.02	1654.08	1476.86	1318.62
Total present benefits			30801.77										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1622.47	6922.15	5230.33	5395.31	4627.70	1043.19	1428.48	861.68	687.93	830.46	546.77	437.19	390.35
Total present cost			32182.17										
Net profit	-585.08	-2391.86	-1508.72	-1869.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			-1380.40										
IRR			13%										
B/C ratio			0.96										

Appendix G5

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1177.34	1051.20	938.57	838.01	748.22	668.05	596.48	532.57	475.51	424.56	379.07	276.60	246.97
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	349.04	311.64	278.25	272.32	221.82	198.34	177.09	161.32	141.17	138.15	112.71	100.63	89.85
Total present cost													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix G5

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	1899.18	2419.76
Present benefits	220.51	196.88	175.79	156.95	140.14	125.12	111.72	99.75	89.06	79.52	71.00	63.39	56.60	64.39
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	690.94	704.94	690.94	690.94	690.94	757.18	690.94	690.94	690.94	690.94	690.94
Present costs	80.22	71.63	70.08	57.10	52.02	45.52	40.64	36.29	35.51	28.93	25.83	23.06	20.59	18.38
Total present cost														
Net profit	1208.24	1208.24	1142.00	1208.24	1194.24	1208.24	1208.24	1208.24	1142.00	1208.24	1208.24	1208.24	1208.24	1728.82

Appendix H1

Cost benefit analysis in B8A WUA- Project Scenario 3 at 8% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1469.12	1386.20	1211.58	2517.52	2331.04	2186.21	1899.18	1628.24	1844.76	1708.11	1581.58
Total present benefits			35322.14										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1169.58	4427.16	4054.80	4337.61	3858.28	901.96	1280.83	801.23	687.93	893.12	609.80	505.65	468.19
Total present costs			29222.55										
Net profit	-585.08	-2391.86	-1608.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			6099.59										
IRR			13%										
B/C ratio			1.21										

Appendix H1

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1464.43	1355.95	1255.51	1162.51	1076.40	996.66	922.84	854.48	791.18	732.58	678.31	513.29	475.27
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	434.15	401.99	372.21	377.78	319.11	295.90	273.98	258.84	234.90	238.38	201.68	186.74	172.91
Total present costs													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix H1

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	849.36	849.36	849.36	849.36	849.36	530.85	530.85	530.85	530.85	530.85
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1474.50	1474.50	1474.50	1474.50	1474.50	1155.99	1155.99	1155.99	1155.99	1676.57
Present benefits	440.06	407.47	377.28	349.34	251.13	232.53	215.30	199.36	184.59	134.00	124.07	114.88	106.37	142.84
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	696.96	710.96	696.96	696.96	696.96	763.20	696.96	696.96	696.96	696.96	696.96
Present costs	160.10	148.21	150.42	128.20	121.09	109.91	101.77	94.23	95.54	80.79	74.80	69.26	64.13	59.38
Total present costs														
Net profit	1208.24	1208.24	1142.00	1202.22	763.54	777.54	777.54	777.54	711.30	459.03	459.03	459.03	459.03	979.61

Appendix H2

Cost benefit analysis in B8A WUA- Project Scenario 3 at 9% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.06	19.06	19.06	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1567.03	1465.01	1268.72	2612.06	2396.39	2226.88	1899.18	1598.50	1794.45	1646.28	1510.35
Total present benefits			33742.15										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1270.73	4765.93	4325.03	4584.24	4040.24	935.83	1316.74	816.14	687.93	876.80	593.17	487.95	447.11
Total present costs			29722.28										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1636.93	1636.93
NPV			4019.86										
IRR			13%										
BC ratio			1.14										

Appendix H2

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1385.64	1271.23	1166.27	1069.97	981.62	900.57	826.21	757.99	695.41	637.99	585.31	438.85	402.61
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	410.79	376.87	345.75	347.70	291.01	267.37	245.30	229.61	206.46	207.60	174.08	159.66	146.47
Total present costs													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix H2

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	849.36	849.36	849.36	849.36	849.36	530.85	530.85	530.85	530.85	530.85
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1474.50	1474.50	1474.50	1474.50	1474.50	1155.99	1155.99	1155.99	1155.99	1676.57
Present benefits	369.37	338.87	310.89	285.22	203.16	186.38	170.99	156.88	143.92	103.52	94.97	87.13	79.93	106.36
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Canal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	696.96	710.96	696.96	696.96	696.96	763.20	696.96	696.96	696.96	696.96	696.96
Present costs	134.38	123.29	123.95	104.67	97.96	88.10	80.82	74.15	74.49	62.41	57.26	52.53	48.19	44.21
Total present costs														
Net profit	1208.24	1208.24	1142.00	1202.22	763.54	777.54	777.54	777.54	711.30	459.03	459.03	459.03	459.03	979.61

Appendix H3

Cost benefit analysis in B8A WUA- Project Scenario 3 at 10% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1670.48	1547.53	1327.99	2709.25	2462.95	2267.93	1899.18	1569.57	1745.96	1587.23	1442.93
Total present benefits			32448.61										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quay Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1379.59	5127.16	4610.54	4842.44	4229.01	970.65	1353.32	831.18	687.93	860.94	577.14	469.87	427.15
Total present costs			30392.52										
Net profit	-685.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			2056.09										
IRR			13%										
B/C ratio			1.07										

Appendix H3

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1311.76	1192.51	1084.10	985.54	895.95	814.50	740.45	673.14	611.95	556.31	505.74	375.74	341.58
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	388.89	353.53	321.39	320.27	265.61	241.82	219.84	203.91	181.68	181.02	150.37	136.70	124.27
Total present costs													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix H3

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	849.36	849.36	849.36	849.36	849.36	530.85	530.85	530.85	530.85	530.85
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1474.50	1474.50	1474.50	1474.50	1474.50	1155.99	1155.99	1155.99	1155.99	1676.57
Present benefits	310.53	282.30	256.64	233.31	164.67	149.70	136.09	123.72	112.47	80.16	72.87	66.25	60.23	79.41
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	696.96	710.96	696.96	696.96	696.96	763.20	696.96	696.96	696.96	696.96	696.96
Present costs	112.97	102.70	102.32	85.62	79.40	70.76	64.33	58.48	58.21	48.33	43.94	39.94	36.31	33.01
Total present costs														
Net profit	1208.24	1208.24	1142.00	1202.22	763.54	777.54	777.54	777.54	711.30	459.03	459.03	459.03	459.03	979.61

Appendix H4

Cost benefit analysis in B8A WUA- Project Scenario 3 at 11% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1779.73	1633.88	1389.47	2809.12	2530.74	2309.35	1899.18	1541.42	1699.19	1530.80	1379.10
Total present benefits			31396.50										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			16.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1490.65	5512.13	4912.07	5112.65	4424.76	1006.43	1390.56	846.36	687.93	845.49	561.68	453.16	408.25
Total present costs			31217.51										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			178.99										
IRR			13%										
B/C ratio			1.01										

Appendix H4

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1242.43	1119.31	1008.38	908.45	818.43	737.32	664.25	598.43	539.12	485.70	437.56	322.16	290.24
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Canals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Canals Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	368.33	331.83	298.95	296.22	242.63	218.91	197.21	181.27	160.06	158.04	130.10	117.21	105.59
Total present costs													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix H4

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	849.36	849.36	849.36	849.36	849.36	530.85	530.85	530.85	530.85	530.85
5 Reduce cost for management	4.6	4.6	4.6	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1474.50	1474.50	1474.50	1474.50	1474.50	1155.99	1155.99	1155.99	1155.99	1676.57
Present benefits	261.47	235.56	212.22	191.19	133.73	120.47	108.54	97.78	88.09	62.22	56.05	50.50	45.49	59.44
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	696.96	710.96	696.96	696.96	696.96	763.20	696.96	696.96	696.96	696.96	696.96
Present costs	95.13	85.70	84.61	70.16	64.48	56.94	51.30	46.22	45.59	37.51	33.79	30.45	27.43	24.71
Total present costs														
Net profit	1208.24	1208.24	1142.00	1202.22	763.54	777.54	777.54	777.54	711.30	459.03	459.03	459.03	459.03	979.61

Appendix H5

Cost benefit analysis in B8A WUA- Project Scenario 3 at 12% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86	2323.86
Present benefits	0.00	0.00	1895.04	1724.21	1453.19	2911.72	2599.75	2351.15	1899.18	1514.02	1654.08	1476.86	1318.62
Total present benefits			30549.62										
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8			
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.96	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6		
7 Repair B8A WUA office building											8		
8 Fee reduction due to natural disaster					41.6						66.24		
II.2 Public costs													
9 Construction B8A WUA office building	20												
10 Land cost for B8A WUA office	16												
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67								
12 Quy Xa Sluice rehabilitation cost	48.39												
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93	687.93
Present costs	1622.47	5922.15	5230.33	5395.31	4627.70	1043.19	1428.48	861.68	687.93	830.46	546.77	437.19	390.35
Total present costs			32185.48										
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93	1635.93
NPV			-1635.85										
IRR			13%										
B/C ratio			0.95										

Appendix H5

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	1899.18	1899.18
Present benefits	1177.34	1051.20	938.57	838.01	748.22	668.05	596.48	532.57	475.51	424.56	379.07	276.60	246.97
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA								6					
7 Repair B8A WUA office building								8					
8 Fee reduction due to natural disaster				66.24						66.24			
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94	690.94
Present costs	349.04	311.64	278.25	272.32	221.82	198.34	177.09	161.32	141.17	138.15	112.71	100.63	89.85
Total present costs													
Net profit	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	1208.24	1208.24

Appendix H5

Description	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I Benefits														
I.1 Private benefits														
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits														
4 Increased agriculture production	1274.04	1274.04	1274.04	1274.04	849.36	849.36	849.36	849.36	849.36	530.85	530.85	530.85	530.85	530.85
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value														520.575
Total benefits	1899.18	1899.18	1899.18	1899.18	1474.50	1474.50	1474.50	1474.50	1474.50	1155.99	1155.99	1155.99	1155.99	1676.57
Present benefits	220.51	196.88	175.79	156.95	108.80	97.14	86.73	77.44	69.14	48.40	43.21	38.58	34.45	44.61
Total present benefits														
II Costs														
II.1 Private costs														
1 B8A Cannals Construction cost														
2 Maintenance cost	24.07	24.07	24.07	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08	30.08
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA					6									
7 Repair B8A WUA office building					8									
8 Fee reduction due to natural disaster			66.24						66.24					
II.2 Public costs														
9 Construction B8A WUA office building														
10 Land cost for B8A WUA office														
11 Main Cannal Construction (partial) cost														
12 Quy Xa Sluice rehabilitation cost														
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IMC's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees														
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	690.94	690.94	757.18	696.96	710.96	696.96	696.96	696.96	763.20	696.96	696.96	696.96	696.96	696.96
Present costs	80.22	71.63	70.08	57.60	52.46	45.92	41.00	36.60	35.79	29.18	26.05	23.26	20.77	18.55
Total present costs														
Net profit	1208.24	1208.24	1142.00	1202.22	763.54	777.54	777.54	777.54	711.30	459.03	459.03	459.03	459.03	979.61

Appendix II

Cost benefit analysis in B8A WUA- Project scenario 4 at 8% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
I Benefits												
I.1 Private benefits												
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits												
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value												
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86
Present benefits	0.00	0.00	1469.12	1386.20	1211.58	2517.52	2331.04	2186.21	1899.18	1628.24	1844.76	1708.11
Total present benefits			31905.34									
II Costs												
II.1 Private costs												
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8		
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6	
7 Repair B8A WUA office building											8	
8 Fee reduction due to natural disaster					41.6						66.24	
II.2 Public costs												
9 Construction B8A WUA office building	20											
10 Land cost for B8A WUA office	16											
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67							
12 Quy Xa Sluice rehabilitation cost	48.39											
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10		10			
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93
Present costs	1169.58	4427.16	4054.80	4337.61	3858.28	901.96	1280.83	801.23	687.93	893.12	609.80	505.65
Total present costs			27591.79									
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93
NPV			4313.55									
IRR			12%									
B/C ratio			1.16									

Appendix II

Description	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04
6 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													1249.38
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	3148.56
Present benefits	1581.58	1464.43	1355.95	1255.51	1162.51	1076.40	996.66	922.81	854.48	791.18	732.58	678.31	850.96
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	21.06	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA									6				
7 Repair B8A WUA office building									8				
8 Fee reduction due to natural disaster					66.24						66.24		
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	687.93	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94
Present costs	468.19	434.15	401.99	372.21	377.78	319.11	295.90	273.98	258.84	234.90	238.38	201.68	186.74
Total present costs													
Net profit	1635.93	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	2457.62

Appendix I2

Cost benefit analysis in B8A WUA- Project scenario 4 at 9% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
I Benefits												
I.1 Private benefits												
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits												
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value												
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86
Present benefits	0.00	0.00	1567.03	1465.01	1268.72	2612.06	2396.39	2226.88	1899.18	1598.50	1794.45	1646.28
Total present benefits			30990.63									
II Costs												
II.1 Private costs												
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8		
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6	
7 Repair B8A WUA office building											8	
8 Fee reduction due to natural disaster					41.6						66.24	
II.2 Public costs												
9 Construction B8A WUA office building	20											
10 Land cost for B8A WUA office	16											
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67							
12 Quy Xa Sluice rehabilitation cost	48.39											
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10		
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93
Present costs	1270.73	4765.93	4325.03	4584.24	4040.24	935.83	1316.74	816.14	687.93	876.80	593.17	487.35
Total present costs			28409.39									
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93
NPV			2581.24									
IRR			12%									
B/C ratio			1.09									

Appendix I2

Description	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													1249.38
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	3148.56
Present benefits	1510.35	1385.61	1271.23	1166.27	1069.97	981.62	900.57	826.21	757.99	695.41	637.99	585.31	727.55
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	21.06	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA									6				
7 Repair B8A WUA office building									8				
8 Fee reduction due to natural disaster					66.24						66.24		
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	687.93	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94
Present costs	447.11	410.79	376.87	345.75	347.70	291.01	267.37	245.30	229.61	206.46	207.60	174.03	159.66
Total present costs													
Net profit	1635.93	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	2457.62

Appendix I3
Cost benefit analysis in B8A WUA- Project scenario 4 at 10% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
I Benefits												
I.1 Private benefits												
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits												
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value												
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86
Present benefits	0.00	0.00	1670.48	1547.53	1327.99	2709.25	2462.95	2267.93	1899.18	1569.57	1745.95	1587.23
Total present benefits			30225.87									
II Costs												
II.1 Private costs												
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8		
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6	
7 Repair B8A WUA office building											8	
8 Fee reduction due to natural disaster					41.6						66.24	
II.2 Public costs												
9 Construction B8A WUA office building	20											
10 Land cost for B8A WUA office	16											
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67							
12 Quy Xa Sluice rehabilitation cost	48.39											
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10		
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93
Present costs	1379.59	5127.16	4610.54	4842.44	4229.01	970.65	1353.32	831.18	687.93	860.94	577.14	469.87
Total present costs			29331.93									
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93
NPV			893.94									
IRR			12%									
B/C ratio			1.03									

Appendix I3

Description	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													1249.38
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	3148.56
Present benefits	1442.93	1311.76	1192.51	1084.10	985.54	895.95	814.50	740.45	673.14	611.95	556.31	505.74	622.93
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	21.06	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA									6				
7 Repair B8A WUA office building									8				
8 Fee reduction due to natural disaster					66.24						66.24		
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	687.93	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94
Present costs	427.15	388.89	353.53	321.39	320.27	265.61	241.82	219.84	203.91	181.68	181.02	150.37	136.70
Total present costs													
Net profit	1635.93	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	2457.62

Appendix I4

Cost benefit analysis in B8A WUA- Project scenario 4 at 11% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
I Benefits												
I.1 Private benefits												
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits												
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value												
Total benefits	0.00	0.00	857.22	873.51	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86
Present benefits	0.00	0.00	1779.73	1633.88	1389.47	2809.12	2530.74	2309.35	1899.18	1541.42	1699.19	1530.80
Total present benefits			29595.45									
II Costs												
II.1 Private costs												
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8		
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6	
7 Repair B8A WUA office building											8	
8 Fee reduction due to natural disaster					41.6						66.24	
II.2 Public costs												
9 Construction B8A WUA office building	20											
10 Land cost for B8A WUA office	16											
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67							
12 Quy Xa Sluice rehabilitation cost	48.39											
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10		
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93
Present costs	1496.65	5512.13	4912.07	5112.65	4424.76	1006.43	1390.56	846.36	687.93	845.49	561.68	453.16
Total present costs			30357.89									
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93
NPV			-762.44									
IRR			12%									
B/C ratio			0.97									

Appendix I4

Description	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													1249.38
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	3148.56
Present benefits	1379.10	1242.43	1119.31	1008.38	908.45	818.43	737.32	664.25	598.43	539.12	485.70	437.56	534.10
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	21.06	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA									6				
7 Repair B8A WUA office building									8				
8 Fee reduction due to natural disaster					66.24						66.24		
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	687.93	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94
Present costs	408.25	368.33	331.83	298.95	295.22	242.63	218.91	197.21	181.27	160.06	158.04	130.10	117.21
Total present costs													
Net profit	1635.93	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	2457.62

Appendix I5

Cost benefit analysis in B8A WUA- Project scenario 4 at 12% discount rate

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
I Benefits												
I.1 Private benefits												
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov			4.80	5.12	4.16	6.16	6.16	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits												
4 Increased agriculture production			446.34	446.34	446.34	1274.04	1274.04	1274.04	1274.04	1274.04	1698.72	1698.72
5 Reduce cost for management			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity			27.87	27.87	27.87	69.61	69.61	69.61	94.47	94.47	94.47	94.47
7 Skill improvement in IM			37.22	37.22	37.22	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency			19.05	19.05	19.05	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value												
Total benefits	0.00	0.00	857.22	873.54	824.58	1850.45	1850.45	1874.32	1899.18	1899.18	2323.86	2323.86
Present benefits	0.00	0.00	1895.04	1724.21	1453.19	2911.72	2599.75	2351.15	1899.18	1514.02	1654.08	1476.86
Total present benefits			29085.96									
II Costs												
II.1 Private costs												
1 B8A Cannals Construction cost	343.8	453.3		343.8	253.8		343.8			343.8		
2 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06
3 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC			278.95	293.03	250.79	347.09	347.09	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA		6									6	
7 Repair B8A WUA office building											8	
8 Fee reduction due to natural disaster					41.6						66.24	
II.2 Public costs												
9 Construction B8A WUA office building	20											
10 Land cost for B8A WUA office	16											
11 Main Cannal Construction (partial) cost		1785.67	1785.67	1785.67	1785.67							
12 Quy Xa Sluice rehabilitation cost	48.39											
13 Users contribution			16.98	14.29	14.29	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering			9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs			18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators			64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees	10			10			10			10		
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	585.08	2391.86	2365.94	2733.43	2625.88	662.97	1016.77	686.93	687.93	1041.73	768.17	687.93
Present costs	1622.47	5922.15	5230.33	5395.31	4627.70	1043.19	1428.48	861.68	687.93	830.46	546.77	437.19
Total present costs			31486.51									
Net profit	-585.08	-2391.86	-1508.72	-1859.89	-1801.30	1187.49	833.69	1187.39	1211.25	857.45	1555.69	1635.93
NPV			-2400.55									
IRR			12%									
B/C ratio			0.92									

Appendix I5

Description	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
I Benefits													
I.1 Private benefits													
1 Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
3 Percentage of water fee given by Gov	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
II.2 Public benefits													
4 Increased agriculture production	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1698.72	1274.04
5 Reduce cost for management	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
6 Reduce food scarcity	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47	94.47
7 Skill improvement in IM	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09	74.09
8 Reduce incidence of waterborne disease	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
9 Increased irrigation efficiency	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19	27.19
10 Terminal value													1249.38
Total benefits	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	2323.86	3148.56
Present benefits	1818.62	1177.34	1051.20	938.57	838.01	748.22	668.05	596.48	532.57	475.51	424.56	379.07	458.57
Total present benefits													
II Costs													
II.1 Private costs													
1 B8A Cannals Construction cost													
2 Maintenance cost	21.06	22.06	22.06	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07
3 Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
4 Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
5 Water fee returned to Chu River IMC	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68	367.68
6 Equipments for B8A WUA									6				
7 Repair B8A WUA office building									8				
8 Fee reduction due to natural disaster					66.24						66.24		
II.2 Public costs													
9 Construction B8A WUA office building													
10 Land cost for B8A WUA office													
11 Main Cannal Construction (partial) cost													
12 Quy Xa Sluice rehabilitation cost													
13 Users contribution	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39	20.39
14 Salary for engineering	9	9	9	9	9	9	9	9	9	9	9	9	9
15 Salary for IME's staffs	18	18	18	18	18	18	18	18	18	18	18	18	18
16 Salary for 27 irrigators	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
17 Lost fruit trees													
18 Fish loss	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24	118.24
19 Vegetation loss	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66
Total costs	687.93	688.93	688.93	688.93	755.17	688.93	689.94	689.94	703.94	689.94	756.18	690.94	690.94
Present costs	390.35	349.04	311.64	278.25	272.32	221.82	198.34	177.09	161.32	141.17	138.15	112.71	100.63
Total present costs													
Net profit	1635.93	1634.93	1634.93	1634.93	1568.69	1634.93	1633.92	1633.92	1619.92	1633.92	1567.68	1632.92	2457.62

Appendix J

Collected water fee and O & M costs

Description	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Collected water fee															
1 Water fee for B8A canal			240.00	256.00	208.00	307.80	307.80	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2 Water fee for small-scale canal			76.99	76.99	76.99	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
Total benefits	0.00	0.00	316.99	332.99	284.99	394.42	394.42	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82
Present collected water fee	0.00	0.00	617.73	589.92	458.98	577.46	524.97	505.56	417.82	345.90	313.91	285.37	259.43	235.85	214.41
Total present collected water fee			6977.49												
II O & M Costs															
1 Maintenance cost			15.22	15.98	13.68	18.93	18.93	20.06	21.06	21.06	21.06	21.06	21.06	22.06	22.06
2 Operation cost			19.02	19.98	17.10	23.66	23.66	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
3 Cost for water fee collection			11.41	11.99	10.26	14.20	14.20	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
4 Equipments for B8A WUA		6									6				
5 Repair B8A WUA office building											8				
Total O & M costs	0.00	6.00	45.65	47.95	41.04	56.80	56.80	60.17	61.17	61.17	67.17	61.17	61.17	62.17	62.17
Present O & M costs	0.00	12.86	88.95	84.95	66.09	83.15	75.60	72.80	61.17	50.55	50.46	41.78	37.98	35.09	31.90
Total present O & M costs			1041.55												
Percentage II/I(%)			14.93%												

Appendix J

Description		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I	Collected water fee															
1	Water fee for B8A canal	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20	331.20
2	Water fee for small-scale canal	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62	86.62
	Total benefits	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82	417.82
	Present collected water fee	194.91	177.19	161.09	146.44	133.13	121.03	110.02	100.02	90.93	82.66	75.15	68.32	62.11	56.46	51.33
	Total present collected water fee															
II	O & M Costs															
1	Maintenance cost	22.06	22.06	22.06	23.06	23.06	23.06	23.06	23.06	24.07	24.07	24.07	24.07	24.07	24.07	24.07
2	Operation cost	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
3	Cost for water fee collection	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04	15.04
4	Equipments for B8A WUA						6									
5	Repair B8A WUA office building						8									
	Total O & M costs	62.17	62.17	62.17	63.17	63.17	69.17	63.17	63.17	64.18	64.18	64.18	64.18	64.18	64.18	64.18
	Present O & M costs	29.00	26.37	23.97	22.14	20.13	20.04	16.64	15.12	13.97	12.70	11.54	10.49	9.54	8.67	7.88

Appendix K

Plates of the Field Trip



Plate 1- Chu River



Plate 2 - Quy Xa Sluice, control water from Chu River to irrigation systems



Plate 3 – Gate valves on Quy Xa Sluice



Plate 4 - North Canal, Main Canal, provide water to B8A Canal



Plate 5 - B8A Secondary Irrigation Scheme



Plate 6 - Sluice on B8A Canal



Plate 7 - Intersection between B8A Secondary Canal and B4-8A Tertiary Canal



Plate 8 - B4- 8A Tertiary Canal



Plate 9 - Water is provided to the field during autumn – summer season



Plate 10- Unconcreted canal



Plate 11 - Working with head of B8A WUA and vice director of Thieu Hoa IME



Plate 12 – Researchers on the B8A Canal